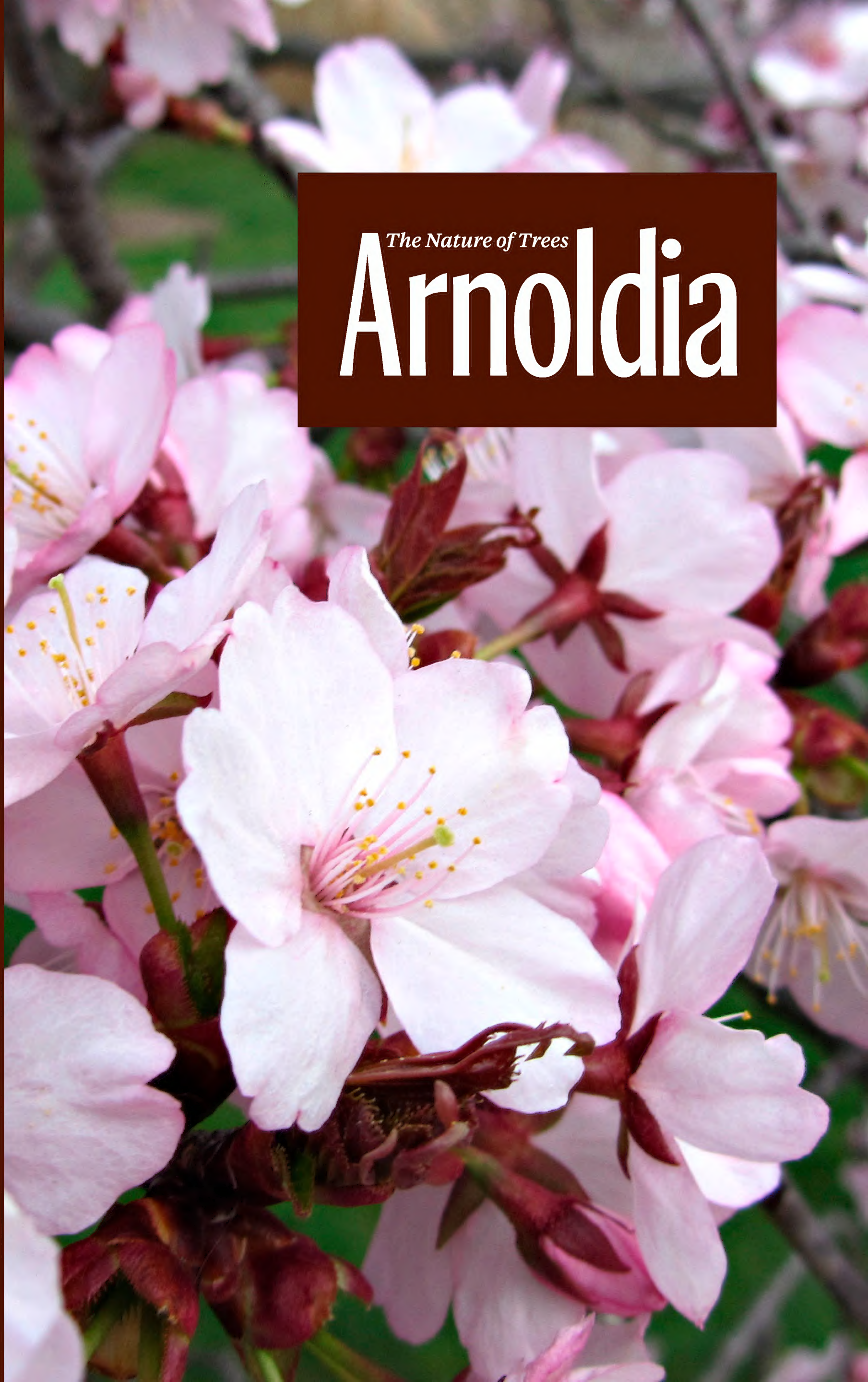

Arnoldia

The Nature of Trees

SPRING 2023

Landscape and Belonging

Georgia O'Keeffe's Garden

Sakura Storytellers

Mexican Dry Forest

Trees teach (us how to love)

By William (Ned) Friedman

Three years ago, unknowingly just before the pandemic, I decided to switch up my teaching at Harvard. Perhaps unbeknownst to many, in addition to being the Director of the Arnold Arboretum, I am also the Arnold Professor of Organismic and Evolutionary Biology at Harvard University. Like all professors, I teach undergraduate classes, lead a research group with graduate students, and am charged with helping young minds begin to self-conceptualize a life that will be rich and rewarding. But rich and rewarding in what ways?

For many years, I taught a freshman seminar called "Getting to Know Darwin," in which thirteen students, a graduate teaching fellow, and I explored Charles Darwin's life from his medical school days in Edinburgh (he dropped out) through old age. Each week we focused on a particular topic, read some of his varied correspondence related to that topic, and then put ourselves in his skin and carried out an experiment or set of observations that he himself made. We visited pigeon fanciers, dangled duck's feet (bought frozen in Chinatown) in small ponds to see what climbed aboard, brought earthworms to the New England Conservatory to see if they could hear a bassoon or piano (they can't), and generally engaged in following Darwin's passions. And passions are indeed what lie at the heart of Darwin's rich and rewarding life—one that was rich in family, friends, and perhaps most rewarding, in having devoted his life to a full immersion in the mysteries and beauty of nature. The first-year students may have thought they were going to learn about a "biographical" Darwin, but my simple goal in this class was for them to learn how one can discover a path in life that is fulfilling. Rather than choosing a career, discover what you are passionate about and stick to it.

After seven years of Getting to Know Darwin, it was time to venture forth and create a new freshman seminar. This time, I wanted my students to explore how we can deepen our lifelong relationships with the natural world. I entitled the course "Tree" and held my breath to see if anyone would join. I worried that most first-year college students would already be focused on which classes they "needed" for their chosen concentration and career. Who would have time to spend a semester thinking about trees and how one might form a unique and personal relationship with trees and nature writ large?

Imagine my joy when nearly 90 students applied for the thirteen slots in the class in 2020. Now, three years on, the class continues to

reap huge numbers of applicants and each year, thirteen wonderful first semester freshmen, just out of high school, with their lives entirely ahead of them, continue to reinvigorate my sense of optimism that the next generation will do far better than mine in stewarding the planet and its biodiversity.

So, what is in the freshman seminar "Tree?" Here is the formal description:

> In an age of environmental destruction and outright murder of our biological brethren, there is something deeply troubling about humanity's relationship with nature. Technology has left us with mere facsimiles of nature—pixilated abstractions of biodiversity through satellite imagery, decoded strings of DNA—and we, as a species, have become fundamentally disconnected from actual nature and the magnificent organisms with which we share the earth. In this seminar, we will work to understand and give agency to trees as individual organisms, literally rooted in the ground, and evolutionarily rooted in deep time.... to initiate a personal and lifelong connection with the "other," the vast and varied organisms with which we share the planet.

During the semester, we read literature, poetry, law (can a tree have legal standing?), and biogeography (the evolutionary historical migrations of trees around the world); we ponder tree longevity (coring a tree on the grounds of the Arboretum to read the rings and see environmental history and climate change recorded in the very cells). We ask why leaves of temperate trees turn red and/or yellow in the fall (we're not exactly sure), and why North America has so many more red-colored fall species than does Europe. We ponder the cultural significance of a handful of pecans given by an enslaved mother to her enslaved daughter as she was sold and carried forever from her family. And we *observe*. Each student picks an individual tree at the Arnold Arboretum (out of 16,000 accessioned woody plants!) to observe each week and report on to the class. We visit these trees collectively, and we reflect on why these trees can bring so much joy and arouse our sense of the beauty and mysteries of the natural world. And interestingly, each year these trees have become a set of gathering places for Tree students to invite their friends to meet "their" trees. In a time of Covid-induced human isolation, these trees have become social networkers!

We reflect on why these trees can bring so much joy and arouse our sense of the beauty and mysteries of the natural world.

In the final analysis, I created this course based on my fervent belief that if each of us can learn to *love* non-sentient individuals such as trees, we can build up our abilities to be empathic to all of nature, and beyond that, to all of our fellow human beings, no matter how different we may seem to each other.

Perhaps the single reading that sums up what I seek to accomplish in Tree is the remarkable short story by Carson McCullers, "A Tree, A Rock, A Cloud." In this story, set in the mid-twentieth century, a transient recounts to a young paperboy his failed attempt at marriage and love of a woman.

> "Son, do you know how love should be begun?"
>
> The boy sat small and listening and still. Slowly he shook his head. The old man leaned closer and whispered:
>
> "A tree. A rock. A cloud....
>
> "For six years now, I have gone around by myself and built up my science. And now I am master. Son. I can love anything.... And anybody. All stranger and all loved! Do you realize what a science like mine can mean?"

I encourage all of you reading this issue of *Arnoldia* to continue your journeys to meet and love nature, one tree at a time. While a tree (or a rock or a cloud) cannot love us, our unreciprocated love of a tree may perhaps be one of the most unalloyed forms of empathy that we, as humans, are capable of. And I am certain that if everyone on the planet had the opportunity to learn to love a tree, the world would be a very different and better place.

WILLIAM (NED) FRIEDMAN *is the eighth director of the Arnold Arboretum and the Arnold Professor of Organismic and Evolutionary Biology at Harvard University.*

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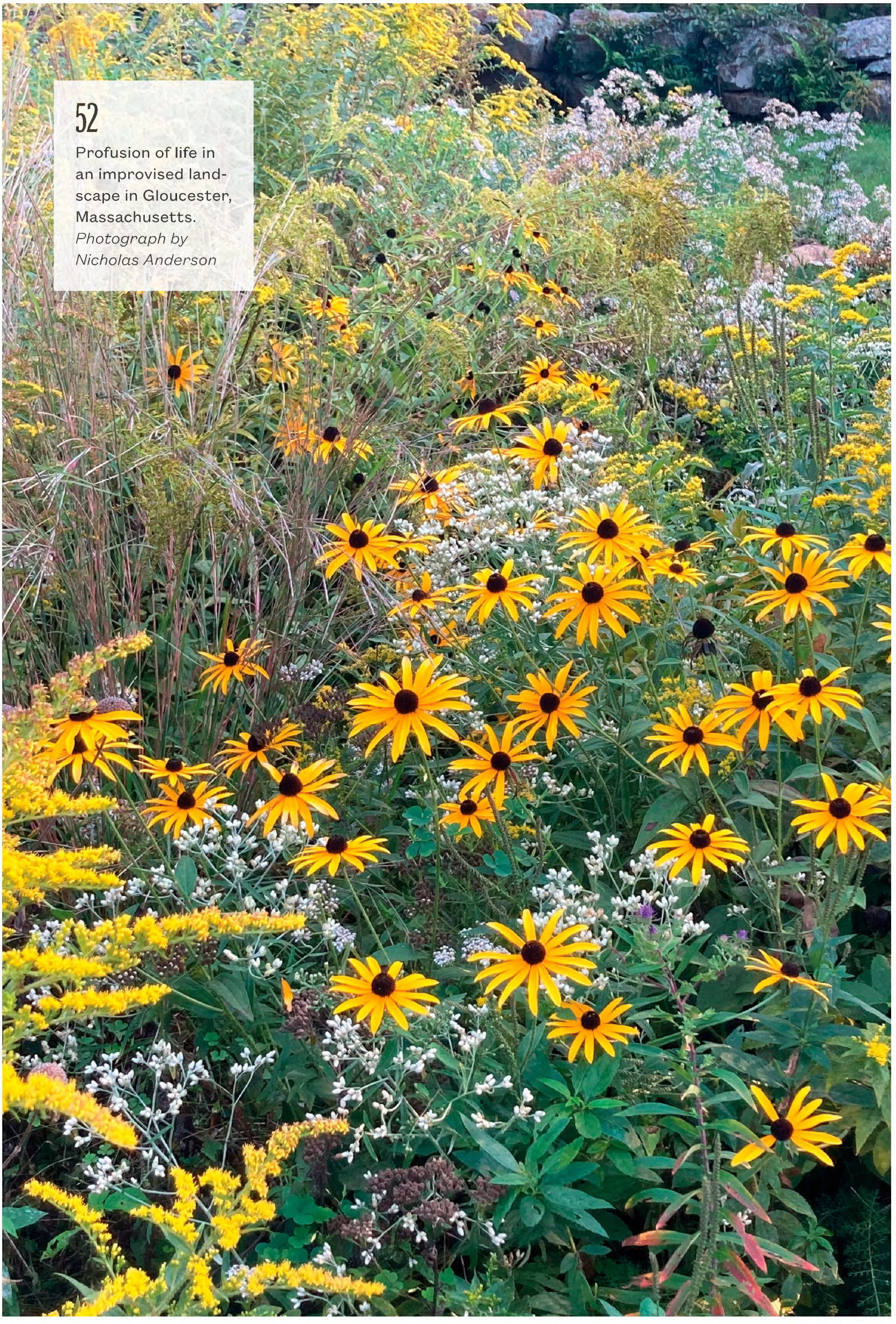

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Profusion of life in an improvised landscape in Gloucester, Massachusetts. *Photograph by Nicholas Anderson*

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Arnoldia
The Nature of Trees

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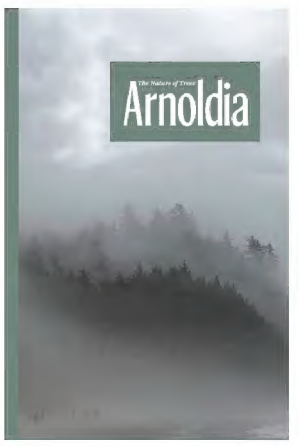
LETTERS



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From Conversation to Connection

I've had the pleasure of writing a few articles about the Arboretum for the British garden quarterly *HORTUS*. And every time, I've reached for *Arnoldia*—first for the facts (I'm not a scientist) and then for the stories behind the beautiful woody plants I'm showcasing. I can be a curmudgeon when it comes to changes to beloved places and periodicals, but the new *Arnoldia* format is a delight.

My last piece on the Arboretum praised its brilliant collaboration with the Harvard Art Museum and its *Painting Edo* exhibition. The "conversation" between those dazzling painted fans and screens that "gobsmacked" Michael Dosmann for their botanical accuracy, and the living plants thriving in the "museum of trees" across the river, helped me see both with fresh eyes.

I get that same frisson of connectivity reading the revamped *Arnoldia*. Without losing scientific rigor, it appeals to all the ways we experience and mediate the natural world—through poetry, image, memory, and of course, the facts. Engaging all our senses is critical as we seek to understand and build resilience in this new world of climate unpredictability. Now *Arnoldia* is my "go to" when it hits my mailbox, not only for specific research, but as a great read from cover to beautiful cover. What an inspiring way to launch the Arboretum's next 150 years.

Sukie Amory
Duxbury, Massachusetts

A LOOK BACK

Xiuying Hu (1910–2012), examines a silk tree (*Albizia julibrissin*) during a field class, ca. 1985. An emeritus senior research fellow of the Arnold Arboretum, Professor Hu collected and identified as many as 185,000 plant specimens over the course of her career. For more about Hu and other women who contributed to the Arnold, past and present, see Lisa Pearson and Miranda Mollendorf, "Woman of the Arnold Arboretum," http://arboretum.harvard.edu/stories/the-gendered-history-of-the-arnold-arboretum/

Ar*chives of the Arnold Arboretum*

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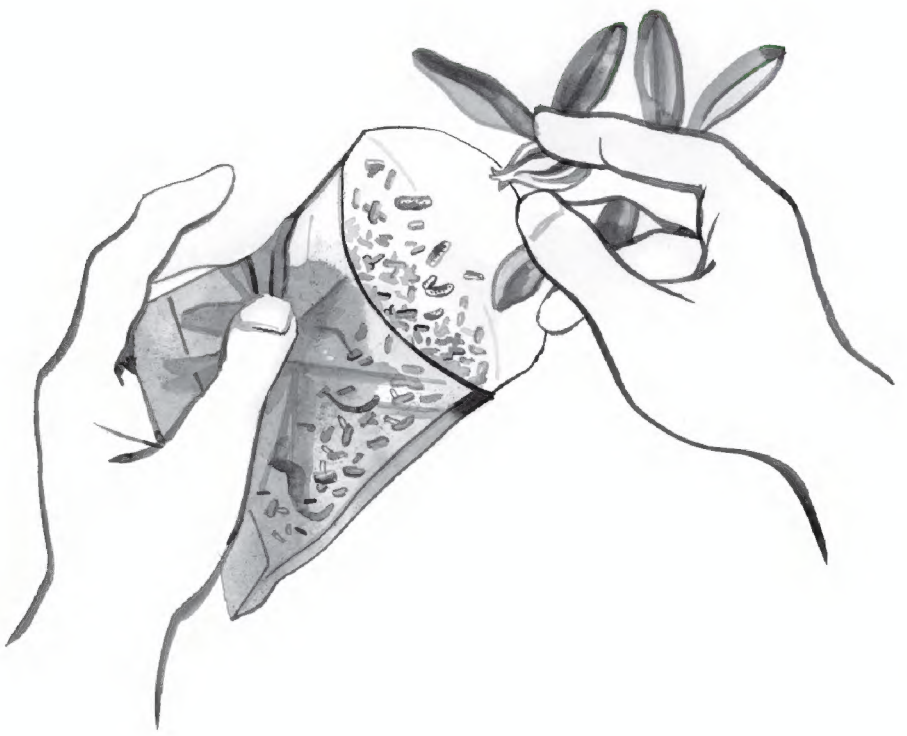
Notes from the Field



A Certain Type of Place

Michael Dosmann and Elizabeth Thomas collect **rare plants in the places of their discovery.**

Michael Dosmann is the keeper of living collections at the Arnold Arboretum.

Elizabeth Thomas is a research associate at Polly Hill Arboretum.

We met Gerry Wilhelm on that late-September morning last year at the side of a tree-lined road within the Jurgensen Woods Nature Preserve. Surrounded by a network of residential communities, commercial development, and highway corridors, this site in Cook County, just south of Chicago, was a bastion for nature and nature lovers alike. Donned in a light-blue button down and a many-pocketed, tan vest, the bespectacled Gerry greeted us with a broad smile. As we stepped into the nearby remnant sand prairie ringed by black oaks and sassafras, we knew we were about to experience something special.

At that time of year, much of the herbaceous vegetation looked a bit drab and tired, the verdant greens of summer waning to olive; late blooming goldenrods and asters complemented the tawny-brown grasses. And yet, dotted around the landscape were these rounded shrubs, about a meter in height and as wide or wider, and covered with glossy, deep green, oblong leaves. This was the muse for the day: *Hypericum swinkianum,* something that neither of us had seen before.

In 2016, while working on the *Flora of the Chicago Region: A Floristic and Ecological Synthesis,* Gerry and his co-author, Laura Rericha-Anchor, published *H. swinkianum* as a new species of St. Johnswort. The name commemorates the late Floyd Swink, botanist at the Morton Arboretum, expert on the region's flora, and mentor to them both. While it was like *Hypericum kalmianum,* another Midwestern native, this one is characterized by larger leaves (up to 5 cm long and 1 cm wide), more numerous flowers in a cluster, and a preference for acidic soils (*H. kalmianum,* in contrast, adores a higher soil pH). The following day, we visited several populations of Kalm St. Johnswort, and in contrasting the two even further, Swink's just had a juicier look to it, its sleek, dark leaves looking plastic-like. Perhaps the robust look had more to do with the local conditions at the population, or maybe there is something baked within? It isn't every day you visit a species' type locality, much less with a person who named it. Where we stood that day in Jurgensen Woods happened to be Swink St. Johnswort's. This means that it was the very spot from which its type specimen was collected. When botanists describe a new-to-science species, they assign it a unique name in Latin, and publish a description of its traits that allows others to distinguish

Illustration by Matt Huynh

it from other species. They also designate a type herbarium specimen—a dried and pressed cutting from the plant stuck to stiff paper—that in the botanists' minds best illustrates those important diagnostic features. Types are revered in herbaria, where they are filed in special cherry-red folders and serve as physical reference forever as to what a scientist hypothesized the species to represent. In other words, it is the "real deal."

While there is great value in preserving and studying those dead plants, there is equal value growing them in an arboretum. No matter how well preserved those flowers are, the color of the petals fades in time. There is also only so much vegetation that you can fit on a sheet of paper roughly 30 cm by 40 cm in size—it is impossible to properly capture the grandeur of an oak or the "juiciness" of this St. Johnswort. As we gathered our seeds from this population (and yes, accompanying herbarium and DNA vouchers, too), we were eager to be the first ever to introduce this species into cultivation at the Arnold and Polly Hill Arboreta, as well as a few other botanical gardens. Not only will those living specimens serve as valued conservation collections, but they also provide ample opportunities for scholars to study, observe, and enjoy them without pressuring the plants in nature. And, like the type specimen in an herbarium, these from the type locality—collected with one of the species' authors, no less—also represents the "real deal!"

If they look this great here, what happens when you give them some horticulture?

Growing plants ex situ in the garden also provides a chance to evaluate a plant species' horticultural value and plasticity. Some plants in the shrub border, exuberant in their display, didn't start out that way. Some are the result of artificial selection via breeding, others are clones of a plant (wild or cultivated) that happened to possess superior traits (larger flowers, uncanny fruit color, variegated leaves). There are also those plants that simply benefit (from an ornamental perspective) from management—siting them under ideal conditions (no competition, just the right amount of

PHOTO: BETHANY VERSOY

OUR WARMING WORLD

Missing: Botanists Worldwide!

In a 2022 online article for *The Conversation*, British scientist Sebastian Stroud sounds the alarm about a global decrease in plant professionals. Working with colleagues from across the U.K., Stroud, a PhD candidate at the University of Leeds, found that the number of botany students at universities was in steep decline, with only 1 in 200 biology majors in the U.K. between 2007 and 2019 focused on plant science. Plants and trees play a crucial role in mitigating the effects of climate change—and as flora respond differently to these changes, botanical knowledge is crucial to our planetary future. As the decline in botanists converges with climate change and biodiversity loss, training and public programs like those here at the Arnold Arboretum are vital refugia for budding botanists. Programs exist for every age, from hands-on outdoor exploration for elementary school kids to postdoctoral research and collegiate internships in public horticulture, helping to safeguard plant knowledge for generations to come.

Manager of Children's education Nancy Sableski leads young scientists through the arboretum.

water and light), giving them a gardener's care (primping, pruning, being spoken to). Looking at those gorgeous plants that day, we could not help but wonder aloud "If they look this great here, what happens when you give them some horticulture?"

Almost every shrub in Jurgensen Woods that day was a mass of vertical, slender stems arising from the base. In a way, the habit was akin to a *Daphne* or a *Genista*. The oldest stems in the middle stood just a bit taller than the rest and possessed a few lateral branches; these also had exfoliating, gray-brown bark. Few of the shrubs seemed more than several years old, making us wonder if they are naturally short-lived. Would the centers eventually die out, leaving a green donut? If so, can they be rejuvenated like other shrubs?

For many summer-flowering shrubs like *Hypericum,* which bloom on new wood, a late-winter or early-spring cut-back can create a compact and densely flowered specimen. Fruiting was heavy on the plants we saw, making it very easy to yield the required seed counts. Pretty much every stem ended in a branched or compound dichasium, a cluster of symmetrically and oppositely paired fruits, some bearing upwards of 30 yellowish-green, fleshy capsules; a few were even turning coral red. The blooming shrub masses must have been a sight to see earlier in the summer. Each flower bears five bright yellow petals about 1.5 cm long that surround a pack of too-many-to-count yellowish stamens. Imagine them juxtaposed against the shiny, blue-green leaves, covering shrubs in a mixed perennial and shrub border.

Of course, it remains to be seen just how amenable to cultivation *Hypericum swinkianum* ends up being. Many a plant, dazzling in nature, evades successful cultivation in anything other than niche garden spaces. (Referring to *Franklinia alatamaha* once in these pages, Peter Del Tredici aptly described such plants as "miffy.") Will this St. Johnswort be similar, resisting cultivated love and requiring the wet, acidic soils reminiscent of the mesic sand prairies it once called home? Or, will they grow – thrive – in drier sites, where the pH is higher and gardeners put them through a range of horticultural calisthenics?

Many a plant, dazzling in nature, evades successful cultivation.

We pondered these questions while slicing open the yellowish-green ovaries with our thumbnails. Although not yet fully ripened into the dry, brown, dehiscing capsules characteristic of mature *Hypericum* fruits, they revealed masses of granular, chocolatey, well-developed seeds inside. Confident they were far enough along to continue ripening off the plant, we fanned across the prairie patch to capture the greatest genetic diversity we could from this persistent population, funneling fistfuls of the ripest fruits into hand-sized glassine seed envelopes, perfect for their non-stick and waterproof properties.

Sometimes, the vagaries of seasons and schedules can find you schlepping to a site only to meet a plant at its phenological margin. This was indeed a trip of margins, and type localities: just the day before, we'd collected the mature "cones" of another rare plant, *Betula murrayana,* also from the exact location—and individual plant!—from which it was originally described. Well into its seed dispersal period, we managed to snag a few of the last-remaining fruits of North America's rarest birch before they were lost to the wind. Visiting two type localities within a three-day collecting trip, and finding both ripe for collection? Yeah, we were lucky.

Walking back to our vehicles with an abundance of seed and a swarm of angry ground hornets at our heels, we continued to muse over the horticultural potential of Swink's St. Johnswort. Could it become the next "must have" summer-blooming shrub for the pollinator garden? And so far, this new species is known to occur only in northern Illinois and Indiana, as well as western Michigan—primarily in the vicinity of Lake Michigan. Will additional populations be discovered?

Time will tell.

A nineteenth-century forest at the bottom of North Reservoir, Middlesex Fells

W. Wyatt Oswald sheds light on the environmental history of a lost landscape.

For those of us who walk in New England's woods, we are rewarded by the regular rhythms of the seasons—the comings and goings of autumn leaves, springtime blossoms, birds migrating in formation—and, if we pay attention, by the occasional, wonderful surprise. I walk most days in the woods of the Middlesex Fells Reservation, a nearly 2300-acre piece of public conservation land spanning parts of the towns of Malden, Medford, Melrose, Stoneham, and Winchester, just north of Boston. I get exercise, I greet friendly dogs and people, and with each outing I become more familiar with the trails, trees, rocks, wetlands, and wildlife of the Fells. And because I'm an ecologist with a focus on past environments, while I'm walking I can't help but read the landscape for clues about its history. The composition of the forest, the growth forms of individual trees, fire-scarred tree trunks, and dilapidated stone walls all hint at past land use or other ecological disturbances.

W. Wyatt Oswald is an environmental scientist and professor in the Marlboro Institute for Liberal Arts & Interdisciplinary Studies at Emerson College.

The trailhead closest to where I live is at North Reservoir, one of three reservoirs that form part of the water-supply system for the town of Winchester, on the west side of the Fells. The North Reservoir dam, built in 1875, has been in need of repair for years, and so this past spring the reservoir was partially drained so that the dam could be reconstructed, a major project featuring all manner of pumps, trucks, and earth-moving equipment. And with the water level several feet lower than normal, a large area of the floor of the reservoir has been exposed.

This fall I decided to circumnavigate North Reservoir and explore the exposed shoreline, figuring I might find a few treasures, like lost fishing tackle or antique beer bottles. I walked along the dry lake bottom, and as I neared the southern end of the reservoir I was surprised to come upon a stone wall. It ran downhill from the upland forest, crossed the mud flats in front of me,

Illustration by Matt Huynh

dropped below water for a short stretch in what remained of the reservoir, then continued across the opposite shoreline, back into the woods. Stone walls aren't as common or prominent in the Fells as in some other parts of New England, and in thick vegetation they may be hard to pick out, but this wall was laid bare, a straight line of piled rocks ranging in size from bread loaves to car tires. The wall was a clear sign that, prior to the creation of North Reservoir, this area had been farmed.

I stepped over the stone wall. A few feet beyond it was a tree stump, rooted in the mud flats and approximately two feet in diameter. It appeared that the bark was gone and the exposed wood was gray, caked with mud in places. The tree had been felled with a "scarf" cut, horizontal cuts on opposite sides of the tree, one slightly higher than the other to determine the direction in which the tree would fall.

I looked up from the stump and was amazed to see dozens of others, spread across an area of the lake bottom the size of a soccer field. It then hit me: I was standing amid a group of trees that had been salvage logged, presumably just before the filling of North Reservoir in 1875. I wandered from stump to stump, observing a range of diameters, from six inches to two feet across. Many of the stumps had decayed, but some were in good enough shape that I could see annual rings on parts of the cut surface. The rings were quite wide, and with some back-of-the-envelope extrapolation I figured the largest trees may have been forty or fifty years old when they were felled. And if the North Reservoir dam was built in 1875, that puts the establishment of those trees at around 1830.

The stumps that remained were frozen in time by the rising water of the new reservoir.

I eventually left the stumps, delighted by my discovery. As I walked towards home, I thought about what had happened at that place in the century or so before it was flooded by North Reservoir, and I started to piece together its ecological and land-use history. During the eighteenth and early-nineteenth century, the land may have been a woodlot, as was the case in parts of what's now the Fells, but more likely it was pasture for sheep or cows, or perhaps farmed for grains, which would have been processed at one of the area's water-powered mills. Once the open field was abandoned, a cohort of trees, probably fast-growing white pines, would have been able to establish in the high-light environment. Henry David Thoreau, who lived at the same time as these trees, observed this phenomenon in nearby Concord: "How suddenly, after all, pines seem to shoot up and fill the pastures!" Over the next few decades, as some of the pioneering white pines succumbed to competition from their neighbors, other trees, perhaps oaks, were afforded opportunities to establish in the understory. Of course none of those trees lived beyond the 1870s, when they fell to a cross-cut saw, their wood milled for lumber or burned to heat homes. And the stumps that remained were frozen in time by the rising water of the new reservoir.

I arrived home with a new understanding of, and appreciation for, the New England woods where I take my walks. I pulled off my boots, still coated with lake-bottom mud, then went to the kitchen to make myself a cup of tea. I smiled to myself upon realizing that the water in which the tea bag was steeping may have flowed through a logged stand of mid-nineteenth-century white pines at the bottom of North Reservoir.

WELL SAID

"If we're going to change the course of American land practices for the better, things need to be simplified to meet people where they live."

Nicholas Anderson in "Improvised Landscapes," which begins on page 53.

Honeysuckles and Hospitality

Peter Zale and Anthony S. Aiello search for azaleas in the deep south.

In September 2021, we embarked on a trip to collect azaleas, particularly *Rhododendron austrinum,* along the Gulf Coast in deep southern Alabama and Georgia. Interest in native azaleas is widely shared amongst horticulturists, botanists, and pretty much anyone even casually interested in plants, so as the trip planning came into focus, unforeseen opportunities to share field work with colleagues and friends helped transform the trip from a simple seed gathering exercise into a memorable experience steeped in southern hospitality.

The reality of plant exploration is that sometimes it can be rather clinical in planning and practice. This is especially true in the U.S., in-depth publications and plentiful herbaria provide detailed location information for even the rarest of species; while this increases the chances of successful collecting, it also dampens the spirit of true exploration, to the point where seed collecting can feel no more satisfying than checking items off a to-do list. Even so, there remain intangibles of plant exploration that cannot be predicted. The location, people, food, and culture give the trip personality, context to the collections, and define the overall experience. In the post pandemic world, the importance of seeing and interacting with people cannot be understated.

Rhododendron austrinum, (Florida azalea) is a species of restricted distribution and conservation concern (Nature Serve: Globally Vulnerable (G3)) across its range on the Florida panhandle and surrounding adjacent counties in Alabama, Georgia, and Mississippi. It most typically grows in the rich, mixed hardwood forest of shallow ravines, although the Gulf Coast Florida populations in Santa Rosa County occur in "sugar sand" soils along the edges of blackwater rivers which may experience tidal influence and brackish water intrusion. These riverside habitats host a staggering diversity of interesting plants, including multiple species of *Sarracenia,* and the fabled *Lilium iridollae,* and an array of choice woody species. Within its limited range, Florida azalea shows variability in phenotype and ploidy, with northern populations generally diploid with yellow-orange flowers, and southern populations usually tetraploid and pink in color. Throughout its range, it occurs sympatrically with a variety of other native azalea species, but most commonly *R. alabamense, R. canescens,* and *R. viscosum* (*sensu lato*). Despite its southern origins, *R. austrinum* is widely reported as a "good doer" with surprising cold hardiness to USDA hardiness zone 5. This, with consideration of its early flowering, overall ornamental value, and conservation value, makes it an easy target for *ex situ* collections and display. In the southeastern U.S., this and other native azaleas are often referred to as "honeysuckle," not to be confused with the genus *Lonicera,* providing a lesson on the importance, history, and regional nature of plant vernacular names, especially when searching for clues about azalea occurrences in the wild.

The first phase of the trip took place at the Solon-Dixon Forestry Center of Auburn

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Illustrations by Matt Huynh

University, where we were invited by colleagues from the Auburn's Davis Arboretum to join them, colleagues from the Polly Hill Arboretum searching for *Stewartia,* and local azalea and woody plant experts. Solon-Dixon lies at the juncture of Covington and Escambia Counties in Alabama and is bounded in some areas by large tracts of Conecuh National Forest. While the primary purpose of the forestry center is to provide educational experiences for Auburn's forestry students, a diversity of natural areas can be found scattered around the property. Here, a rich and changing assortment of floristic curiosities and target species could be found, with 1015 species found in its 5300 acres, accounting for 25% of all known vascular plant species in Alabama. The floristic diversity itself is a reflection of the complicated geology in the region, resulting in a variety of habitat types, including mesic limestone ravines, sand hills, rocky outcrops of ironized sandstone with a xeric flora, and sandy wetland savannahs.

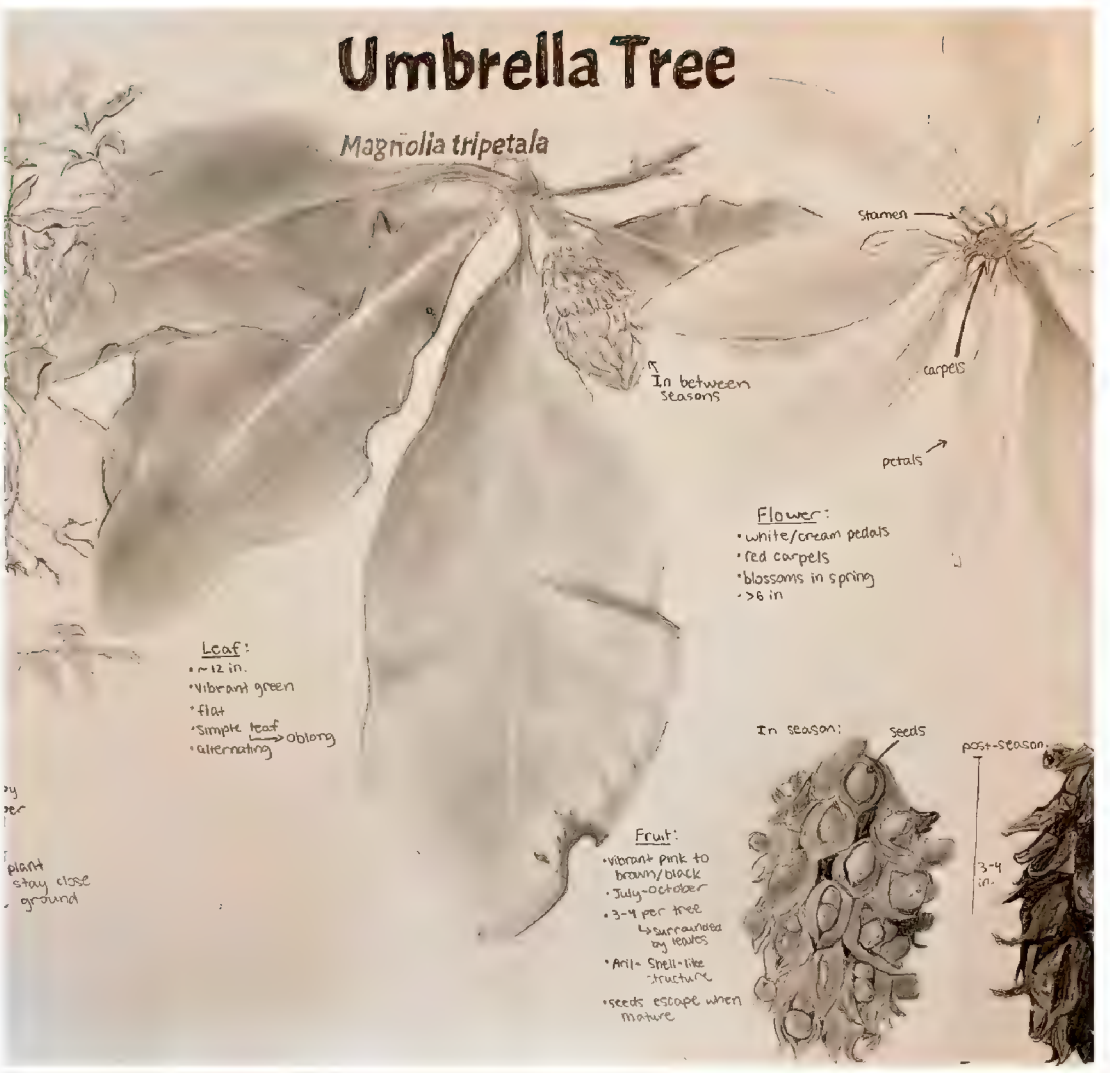
The floristic diversity itself is a reflection of the complicated geology in the region, resulting in a variety of habitat types.

As the group of eight of us started searching, it became immediately evident that *Rhododendron canescens* was the most abundant azalea in the region, found throughout mesic flatwoods, especially adjacent to small stream courses. Not surprisingly, *R. austrinum* was more exacting in its habitat preference. We found it growing in a unique habitats: a shallow ravine created by a meandering stream that resulted in a comparatively high degree of topographic relief compared to nearby areas. The small bluffs of the stream created unique habitat for a variety of rare species including *Stewartia malacodendron, Rhapidophyllum hystrix, Trillium underwoodii,* and *R. austrinum*. Here we found it growing in shrubby thickets near the tops of the bluffs in close association with *R. canenscens* under a canopy of *Pinus glabra, Magnolia grandiflora,* and myriad other hardwoods. Despite the shaded conditions at the site, flowering and seed set for the population was good enough that we could make modest collections of seeds. After an evening of dinner, seed cleaning, and conversation, we set sights for our next collecting location in Southwestern Georgia.

TREE TIME

Winter in Word and Image

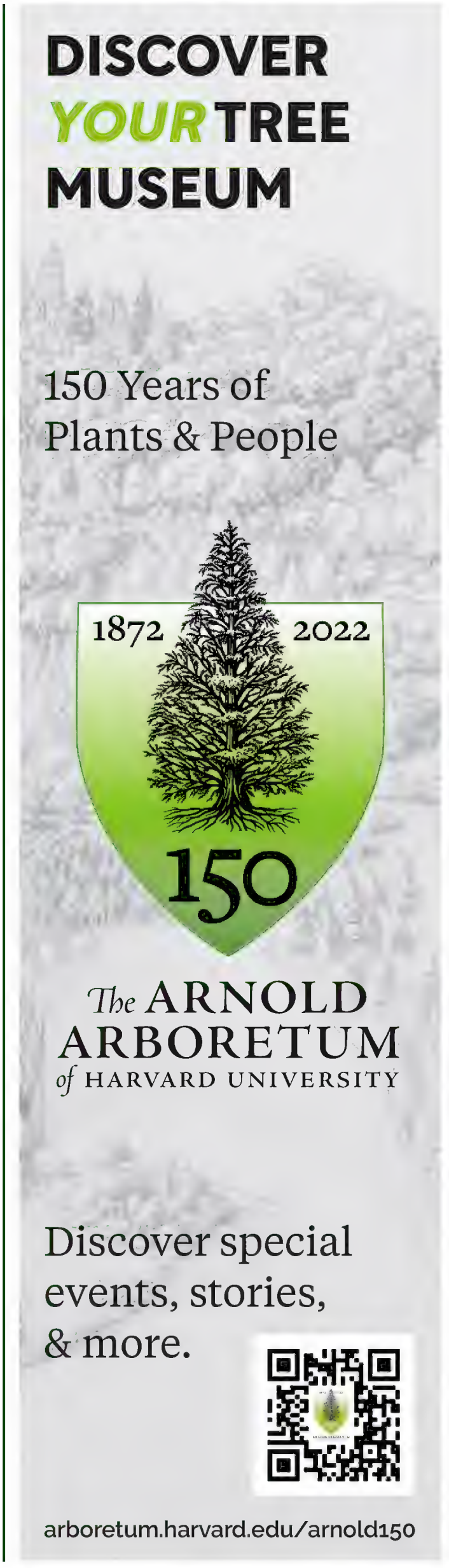
Many a winter tree is bare, making at-a-glance identification more difficult; art students from Brookline High School take up this challenge at the Arnold each year. The arboretum's visitor center recently exhibited their detailed illustrations from the course "Drawing for Understanding in Field Science," taught by Sabine Strauch. Students researched select trees to create in-depth observational illustrations combining text with visually striking images, creating connections between artist, tree, and viewer.



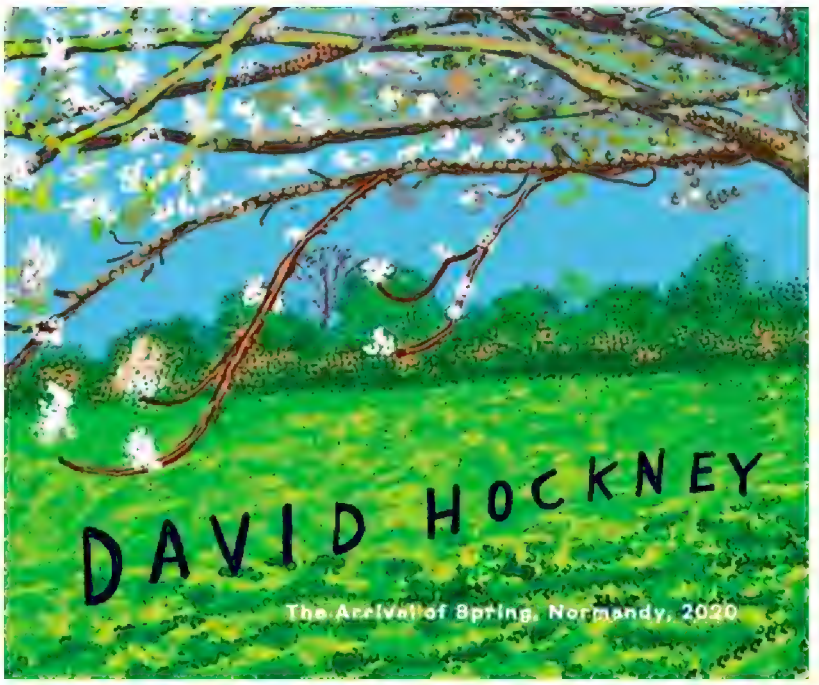
ART: TIA PERCHEVA

Trip planning was aided in large part by a fortuitous article published in the Spring, 2021 issue of *The Azalean* (Journal of the American Azalea Society) that detailed the discovery and documentation of a fascinating occurrence of azalea species near Leesburg, Georgia named "Monica's Swamp." This private 44-acre azalea preserve lies at the northeastern limit of distribution of *R. austrinum* along tributaries of the Flint River, growing near or sympatrically with *R. alabamense, R. canescens, R. viscosum,* and putative hybrid swarms with *R. canescens*. What started as an initial curiosity to know which kinds of "honeysuckle" grew on a neighboring property, exuberant preserve-owner Monica Wiliams ended up purchasing the property and has since developed a strong interest in stewarding, documenting, and preserving this unique concentration of azaleas and associated sand hills flora. Like the Solon-Dixon property, Monica's Swamp is a lesson in geology and hydrology, where subtle changes in elevation and soil types provide a mosaic of different habitats and ecotones that make for interesting breeding grounds for azaleas. Despite growing in close proximity, the four azalea species are separated by changes of just a few feet of elevation and the resulting habitat differences. *Rhododendron austrinum* and *R. canescens* shared similar habitats along small seepage streams. *Rhodoendron viscosum* is a species of peaty, inundated soils often found near open water of shallow ponds. *Rhododendron alabamense* is an upland species, growing on deep sandy soils at "high elevations" in sand hills throughout the swamp. Wherever they occur on her property, Monica has documented the plants, making notes and taking photographs on their phenology and floral phenotypes, resulting in an all-encompassing understand of the plants throughout her property. Her keen observations allowed us to make highly specific seed collections based on her observations.

Seed collecting started quickly after we arrived in the morning and lasted until mid-afternoon; we made the first collections of *R. austrinum,* literally in the



front yard of Monica's neighbor, while *R. canescens* and *R. viscosum* collections were made a short distance away between Monica's and her neighbor's house. We were not prepared for how easily accessible the plants would be, nor the extent of work Monica had put into clearing miles of golf cart paths to access the rare plants throughout her preserve. A good portion of the day was spent winding our way through the preserve while Monica discussed her extensive efforts in clearing paths and freeing the azaleas from the fire-suppressed scrub—giving them a chance for more sunlight and the opportunity to luxuriate. The culmination of the tour was the presentation of the "The Queen"—a remarkably large and vigorous specimen of *R. alabamense* judged by several experts as perhaps the most exceptional specimen of *R. alabamense* known anywhere. Its beautiful and fragrant creamy-white flowers, near-perfectly uniform habit, and large size (12 feet tall by 15 feet wide) made it clear why it was given its moniker. It's hard to imagine a more fitting end to the day than to collect a few treasured capsules from this revered specimen—unique not only for its dimensions, but also a likely source of good genetics for cultivation in northern regions. Satisfied with our seed collections and reeling from the deluge of plants, information, landscapes, and hospitality we encountered through our visit to the south, we retreated to Albany, GA for the evening, and a couple of days later, back to Longwood Gardens.



BOOK BRIEF

Consolations of Spring

The Arrival of Spring in Normandy, 2020, by David Hockney. Royal Academy of Arts, 2021

David Hockney has always been an innovator, pursuing questions of what and how we see with curiosity and great material invention. Now in his mid-eighties, the artist was an early iPad adopter. "Painting" virtually with custom "brushes" on the touch screen, he creates images that grace magazine covers, hang in galleries, and even serve as the basis of a stained-glass window in Westminster Abbey. In early 2020, Hockney took up his iPad to keep a daily record of the landscape around his home in France. The resulting book invites the viewer to take refuge in a brightening world.

As with his paintings and monumental photo collages, Hockney here is always investigating our experience of looking at the world, how we construct knowledge with our eyes. In a nocturne toward the end of the book, the glow of the moon is rendered with the same stencil-like brush pattern used elsewhere to execute bold green foliage, reminding us that our eyes, too, can rhyme, building visual knowledge out of simile and metaphor. But this visual journal becomes more remarkable when we recall the season of its making, the Spring of 2020. Through March into May, Hockney's trees vein with green and burst into baubles of color; limbs and land grow jittery with vernal energy, across pages that powerfully evoke the consolations of nature so many of us sought in those terrible early days of the pandemic.

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Sequoiadendron giganteum

Matthew Battles wraps his mind (and arms) around a would-be giant.

It isn't the biggest tree at the Arnold. Let's set that idea aside right away. This plant, which bears the accession number 1320-72*A, is one of seven specimens of *Sequoiadendron giganteum* (giant sequoia) alive in the landscape, a mix of wild-collected plants and ornamental cultivars. This is one of the wild-born; more than 25 meters in height, it is also the tallest. And yet other trees of impressive size stand nearby: Norway and Oriental spruces loom alongside; a neighboring multi-stemmed *Metasequoia* vies with it for height. Still, something about the tree says *magnitude*. It's there in the genes, sure—the oldest giant sequoias are the most massive trees on Earth. While this specimen is comparatively small, its thick, ropy bark and radiating fretwork of shaggy limbs convey size as platonic ideal. Walk up to the tree, give it a knock with your knuckles: the sound is resonant, deep-rooted, the trunk a living marimba ringing with the sound of bigness borne in the bones of the tree down to the heartwood.

Called *Wawona* by the Miwok people, *Sequoiadendron giganteum* was unknown to Europeans until the 1850s; the species would barely survive its so-called discovery. In 1854, a crew stripped one tree of its bark to a height of 100 feet and sent the hollow husk out on exhibit around the world; the tree itself was left to die in place. "Such was its vitality," wrote *Harper's Weekly* in 1858, that it "put forth green leaves until the past year, when its blanched and withered limbs showed that nature was exhausted." Soon, there was a rush to carve up the big trees for novelty's sake. Hotels were erected amid the wrecked groves, and tourists square-danced atop stumps bearing millenna of rings.

Once widespread throughout Eurasia and North America, *Sequoiadendron* retreated to its current range at the end of the last ice age, clustering in mixed groves on the slopes of the western Sierra Nevada. Despite widespread ornamental planting and afforestation efforts in California, the big trees are not reproducing fast enough to replace the population in a range that will shrink ever higher into the hills as global warming advances. What kind of future can *our* big tree expect? With bigness in its bones and longevity in its genes, 1320-72*A is one of the few trees on the landscape that could outlast our thousand-year lease.

Matthew Battles is the editor of *Arnoldia* and the author of *Tree* (Bloomsbury 2017), among other books.

Photograph by William (Ned) Friedman

MODERN COLLECTIONS

Building Paths for Tree Conservation in Mexico: the Seasonally Dry Forest of the *Bajío Mexicano*

By Emiliano Sánchez Martínez, María Magdalena Hernández Martínez, Yazmin Hailen Ugalde de la Cruz, and Beatriz Maruri Aguilar

The Cadereyta Regional Botanic Garden is a nonprofit institution committed to the conservation of flora from its two regions of influence: the semiarid zone of Querétaro and Hidalgo (together comprising the southern end of the Chihuahuan Desert), and the entire state of Querétaro. Part of the state lies in the rain shadow of the eastern Sierra Madre, where it hosts a distinctive and threatened flora: the seasonally dry forest. The plants of this biome have been poorly understood—seen as dry scrub, believed to be too slow-growing to respond robustly to

Mature dry-forest relict found near the urban sprawl of Santiago de Querétaro, 2009.

active propagation programs. In this article, we describe the seasonally dry forest in its geographic and ecological context, and discuss our efforts to develop protocols for propagating select species not only to conserve and reforest this region, but to share this distinctive group of plants with the public. With the success of this program in mind, we conclude by examining the state of private and public-sector forest conservation in Mexico today, and roles for public gardens and arboreta in preserving Mexico's distinctive floristic communities.

A Densely Diverse Landscape

The wide variety of landscapes of the state of Querétaro in Central Mexico lies in the combination of its abiotic components. Being a small territory of 11,699 square kilometers—less than one percent of the national territory—it encompasses three physiographic regions: the Eastern Sierra Madre, the Trans-Mexican Volcanic Belt, and the Central Plateau, each with unique characteristics that influence the weather, soils, vegetation types, and, of course, human activities.

In the northeastern part of the state, the Eastern Sierra Madre contains karst mountains with steep slopes of sedimentary rock, narrow valleys, deep canyons, and considerable variation in altitude. The highest elevations produce an orographic or "rain shadow" effect, which defines the region's southernmost part as the driest area of the state, contrasted with the temperate and tropical forests of the humid northeast area. Running through the southern region, the Trans-Mexican Volcanic Belt's hills, mountains, and plains are filled with pumice and lacustrine deposits. This region contains the state capital, Santiago de Querétaro, which is located in a tectonic pit. The Central Plateau includes the Sierra del Zamorano Mountains, small plateaus, and volcanic structures—a variety of physiographic features reminiscent of the complexity of the Mexican landscape as a whole, resulting in an intricate mosaic of vegetation, including almost all of the country's significant plant groups.

The influence of the encounter between Holarctic and tropical flora is evident in the landscape through the presence of Northern Hemisphere–flora, including Cupressaceae, Pinaceae, Taxaceae, and Taxodiaceae, which are well represented by a wide range of conifers such as *Abies, Cupressus, Juniperus, Pinus, Pseudotsuga, Taxodium,* and *Taxus*. The distribution of these genera is concentrated in the Eastern Sierra Madre in the north-northeast and in the Sierra del Doctor, a singular calcareous massif attached to the range, though with different origins and features. Some of these conifers can still be found in small patches of single-species forests, such as *Abies, Cupressus,* and *Juniperus*. Other species grow in forests of *Pinus* or *Quercus,* and still others appear in the cloud forests of the northeastern corner of Querétaro.

The presence of the Fagaceae is important, as it links with the temperate flora of the Northern Hemisphere. Of the 161 Mexican oak species, 37 are distributed throughout Querétaro, and 11 are endemic to the region. They can be found in *Quercus*-dominated forests or mixed in with other vegetation under various environmental conditions. Oaks are essential elements of the cloud forest, the *Abies* and *Juniperus* forests, *Pinus* or *Quercus* forests, the tropical deciduous forests of drier landscapes, and are even found in xerophytic or dry scrub communities. It is worth noting that in the central and southern portions of Querétaro, oak forests are typical of soils derived from igneous rocks. These patches are frequently adjacent to grasslands and xerophytic scrub, with several such oak species being shrub-like. However, some relevant species of trees of the Ericaceae (*Arctostaphylos*), Salicaceae (*Salix*), and Scrophulariaceae (*Buddleja*) can also be found here, in combination with *Pinus* and *Quercus*.

Superimposed and intertwined with these Northern Hemisphere-influenced flora is a significant variety of arboreal vegetation of tropical origin. The Eastern Sierra Madre hosts a meaningful number of tropical deciduous forests and small but critical patches of cloud forest. The former presents a community of short trees—branched from lower levels with broad crowns—that lose their leaves for half of the year. One may find remarkable species of Apocynaceae (*Thevetia*), Bombacaceae (*Bombax*), Burseraceae (*Bursera*), Fabaceae (*Erythrina, Lysiloma, Vachellia*), Moraceae (*Ficus*), Myrtaceae (*Psidium*), Oleaceae (*Fraxinus*) and Rutaceae (*Casimiroa, Esenbeckia*) sharing habitat with other cast members. A distinct type of tropical deciduous biome, the seasonally dry forest, is distributed throughout the southwest and is still present in relicts in the vicinity of the capital city of Querétaro. A detailed description of this forest forms the core of this article.

The central portion of Querétaro lies beyond the mountainous terrain of the Eastern Sierra Madre. Appearing bare and deserted at first glance, the region nevertheless hosts a relevant catalog of

The *Bajío Mexicano* is spread across several states in Central Mexico.

tropical plant communities with xerophytic affinity, organized as different types of scrublands. Considered the southern end of the Chihuahuan Desert, the area hosts a remarkable diversity of endemic Cactaceae, including noteworthy examples of columnar, tree-like cacti (*Cephalocereus, Lophocereus, Myrtillocactus, Opuntia, Pilosocereus, Stenocereus*). Throughout this shrubby community, certain trees determine the look and use of the landscape, including members of the Asparagaceae-Agavoideae (*Yucca*), Convolvulaceae (*Ipomoea*), Fabaceae (*Bauhinia, Erythrina, Eysenhardtia, Prosopis, Senna, Vachellia*), and Rubiaceae (*Nernstia*).

The primary source of knowledge of local flora is the book *Flora del Bajío y Regiones Adyacentes,* which has compiled information on 225 families since its initial publication in 1991. The recently updated list of Mexican vascular flora, compiled by Villaseñor in 2016, enumerated 4,411 characteristic species in Querétaro. Over the years, several authors have compiled lists of flora in Querétaro, including the booklet "*Árboles nativos del Estado de Querétaro con potencial ornamental* and *Catálogo básico y formas de propagación,*" published by the Cadereyta Regional Botanic Garden in 2017. The latter refers specifically to trees, and includes 388 species in 79 families, most of them with ornamental potential.

The Seasonally Dry Forest of the *Bajío Mexicano*

The seasonally dry forest may have originated in the Pliocene epoch, some 2.58 million years ago, as fluctuations in climate gave way to an increase of dry conditions of the Pleistocene. Massive geological and climactic events—such as the rising of the Eastern Sierra Madre and the Trans Mexican Volcanic Belt—protected central-western Mexico from cold and chilly northerly winds. A period of climatic instability in the tropics occurred in the late Pleistocene, which may have influenced the distribution of today's seasonally dry forest, which had flourished along a strip of warm and dry environments. Geologic and climate events were decisive factors in the emergence of the *Bajío Mexicano* in the Trans-Mexican Volcanic Belt—a group of valleys, plateaus, and minor mountain ranges around 2,000 meters above sea level that are distributed in what today include the states of Querétaro, Guanajuato, Jalisco, Aguascalientes, Zacatecas, and San Luis Potosí. According to some estimates, seasonally dry forests in the *Bajío Mexicano* covered around 11,000 square kilometers until quite recently—8,000 years ago. Today, this forest type has all but disappeared.

A combination of abiotic features was decisive in establishing these tropical seasonally dry forests that thrive in higher altitudes with cooler temperatures—averaging around 20–22°C—and with a low

seasonal rainfall of around 600 millimeters per year. The distribution of these forests at altitudes of 2,000 meters above sea level has led some authors to call them "high seasonally dry forests." These forests change their appearance drastically depending on the season, looking misleadingly drab and sad during late autumn, winter, and into early spring. This all changes in late spring, when many species of plants bloom and summer's rainy season covers the plants' canopies with dense, bright green foliage.

The seasonally dry forest houses considerable biological richness and endemic species because its flora influences sub-humid and xeric affinity communities. Its catalog of trees and shrubs includes at least 124 species from 43 families. The most common families are Fabaceae, Cactaceae, and Asteraceae.

Rise of the City, Fall of the Forest

In the *Bajío Mexicano*, the seasonally dry forest remnants are small patches of a few square kilometers, isolated and surrounded by agricultural areas and transitional xerophytic scrubs with some trees, shrubs, and columnar-arborescent cacti. Estimates suggest that only five percent of the community belongs to the original vegetation, while the remaining ninety-five percent is under succession. In Querétaro, the development of its capital city, Santiago de Querétaro, was a decisive factor in the transformation of the landscape and the disappearance of the seasonally dry forest.

This urban area, located on the eastern edge of the *Bajío Mexicano*, originated in volcanic plains, plateaus, and gentle slopes. Its first inhabitants settled in small, scattered populations around 400 BCE. Spanish colonization brought about new and intensive land-use practices. Significant ecological disruption dates from the eighteenth century, linked to resource exploitation that occurred as the city was becoming one of the most prosperous and beautiful towns of New Spain. Intensive agriculture and livestock farming led to the disappearance of natural vegetation at an accelerated rate. With predators and competitors eliminated or reduced, introduced domestic animal species grazed freely. Mining required a large amount of wood and coal. The growth of all these activities eventually led to the establishment of the Camino Real de Tierra Adentro, a vital commercial route from Mexico City to Santa Fe, which had a strong influence on the territory and the landscape.

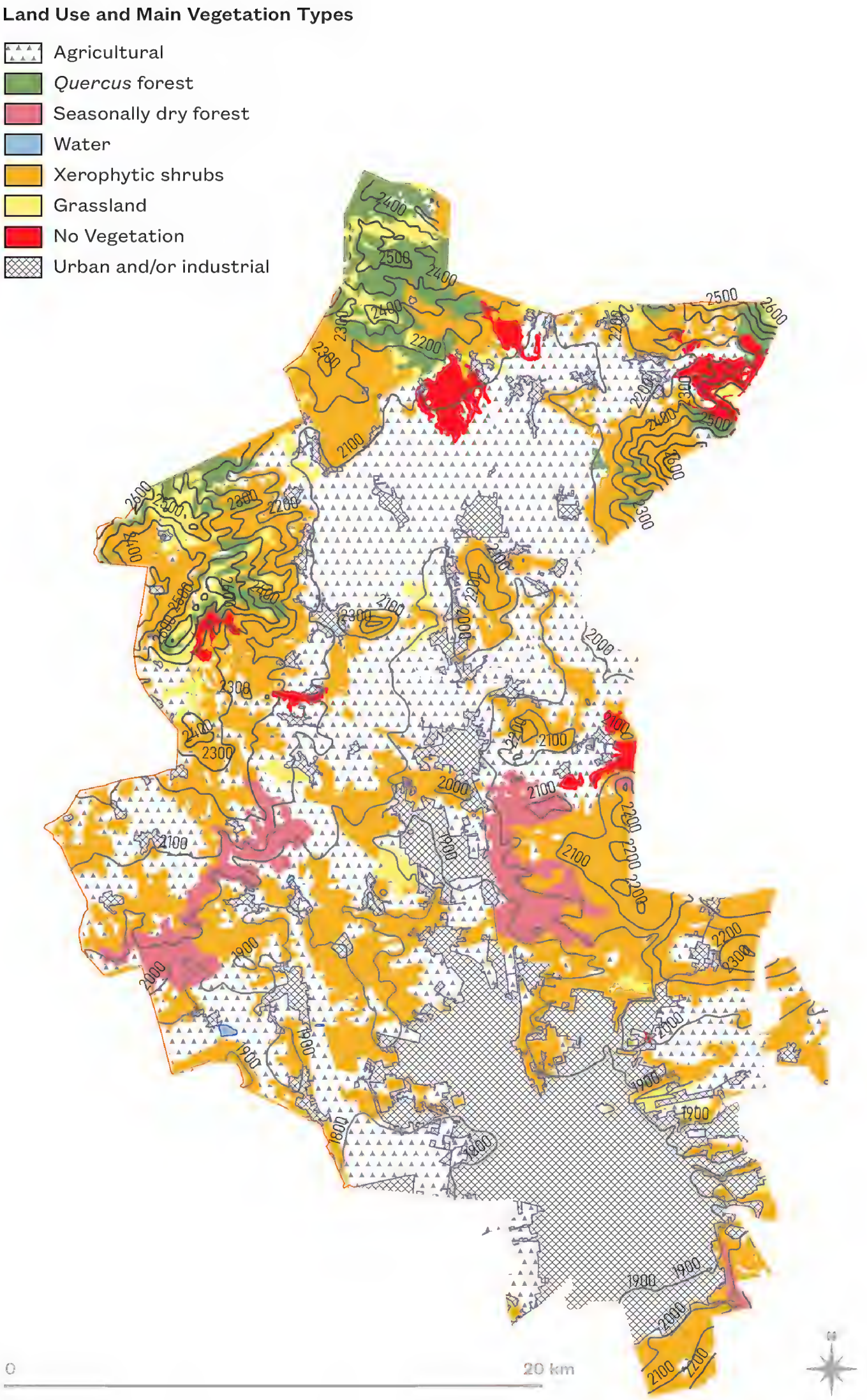
In the nineteenth century, the city's growth rate slowed, until 1950, when real estate development transformed the outskirts of the city. By 1960, Santiago de Querétaro was known as an industrial and commercial center; from 1970 to 2000, its population increased fivefold. By 2020, it was still the second fastest-growing city in Mexico, an extension of urban sprawl that has irreversibly affected the few relicts of the seasonally dry forest. Despite its biological relevance, this type of vegetation is severely threatened; by the 1980s, it was labeled a "vestigial community."

Mexican tree diversity is threatened by an increasing demand for resources, due to the tenfold population growth in the last century. The need for national action is acute. According to recent inventories, vascular plants from Mexico comprise more than 23,000 species, making it the fourth-ranked country globally in terms of plant diversity and the second by number of endemic species (approximately 50 percent). The recent Global Tree Assessment ranks Mexico tenth in the world in terms of tree species diversity, with 3,620 arborescent species, two-thirds of which are threatened (see *Arnoldia* Spring 2022 for reporting on the Global Tree Assessment). Nearly 60 percent of endemic and near-endemic tree species in Mexico are listed as "threatened" by the International Union for Conservation of Nature.

Steps Towards Conservation

The Cadereyta Regional Botanic Garden is committed to the conservation of flora from its two regions of influence: the semiarid zone of Querétaro and Hidalgo, and the entire state of Querétaro. In 2006, the Mixed Funds (*Fondos Mixtos* or FOMIX) of the National Council of Science and Technology (CONACYT), which support state and municipal scientific and technological development, published a call for proposals "to determine the forms of propagation of native plant species (by seed, cuttings, propagules, tissue culture) that best result for reforestation programs," giving highest priority to "arboreal, shrubby, and endemic" species. The botanic garden prepared a proposal to fulfill the request through two chief products: a publication with propagation techniques for native plants, and a stock of plants reproduced with such practices. The objective was not only to foster ex-situ conservation, but also to prepare the way for reforestation.

In the first stage of work, following extensive review of existing records in herbaria and relevant publications, we conducted a field survey to catalog trees and shrubs of the seasonally dry forest. Next, an index for selecting key species was built to prioritize



The ecology of the municipality of Querétaro is drastically transformed due to changes in land use. However, relicts of the seasonally dry forest are still present on slopes surrounding the capital city, Santiago de Querétaro.

The objective was not only to foster ex-situ conservation, but also to prepare the way for reforestation.

selection, field collection of germplasm, and subsequent trial and development of propagation techniques. The index integrated not only the morphological and ecological characteristics of the species, but also their anthropogenic uses. The resulting list of 45 key plant species, consisting almost entirely of trees along with woody shrubs, tree-like miniature succulents, and some relevant herbaceous species, provided a basis for determining which plants to propagate for the conservation of the seasonally dry forest.

The core task of the second stage was the development of propagation techniques or protocols, along with the installation and equipment of two greenhouses and one shade house at the Wild Plants Propagation Unit (*Unidad de Propagación de Plantas Silvestres,* UPPS) of the garden. At this stage, a sequence for the propagation of the selected species was designed and proposed through a production line adjusted to an intermediate technology level. Propagation by seed was the preferred mechanism, although other possibilities of asexual reproduction were explored. The original proposal aimed to develop standardized protocols keyed to least 20 species; the final version included 35, including planting methods without pre-germination treatment (12), with pre-germination treatment (16), in vitro tissue culture (4), and by cuttings (3).

The published work offers a detailed guide to each species, including a synthesis of its known and potential uses, the procedure for its introduction to cultivation, its landscape value, and a watercolor illustration. It also offers general procedures for tree cultivation and management to be put into practice at the botanic garden, developed with the distinctive requirements of dry-forest flora in mind. The recommended period for germination runs from March to October or November. Regular watering, phytosanitary supervision, and growth monitoring should be constant throughout the process. Winter lets the plants have a natural dormancy period. When required, pruning is done in the cold season.

In the third stage, 3,000 native plants were potted and given to Querétaro Environmental Trust (*Fideicomiso Queretano del Medio Ambiente,* or FIQMA)—the organization that had put the original request for research proposals to CONACYT.

Fieldwork allowed us to collect enough information to evaluate the structural organization of the seasonally dry forest. Initially, we organized the plant community of this forest into four groups according to the species' biological characteristics: first, woody

shrubs with single stems, with leaves, with or without thorns; second, woody shrubs with multiple stems and leaves, with or without thorns; third, succulents with spines, with tree-like structures; and fourth, tree species with a well-defined trunk. However, the species in these groups may occur in different organized patterns according to the forest's age and condition and may play different roles—either as early colonizers, pioneer trees and shrubs, or as water keepers. In light of this, we reorganized the 45 key species of the seasonally dry forest into one of the three groups based on their ecological role.

At the Cadereyta Regional Botanic Garden, the propagation of key species of the seasonally dry forest has been ongoing in subsequent years. Thousands of seedlings have grown into young trees. Thousands of people have learned about the importance, value, and unfortunate rarity of this type of forest while walking along the stretch of "Trees from the Querétaro Valley" (*Árboles del Valle de Querétaro*). In contrast to other sections of the botanic garden—which generally display specimens collected as mature plants from their natural habitats—this one features young trees grown from seed. This collection is a powerful tool to communicate the importance of cultivating native species. Home gardeners in Mexico often prefer popular quick-growing exotics like *Jacaranda* and *Eucalyptus*. But in contrast to common belief, it is possible to plant a patch of seasonally dry forest and watch it grow—and our public collection may induce gardeners to trial these fascinating endemic plants for themselves.

All visits to the garden include guided tours, available 365 days a year. Responses to special requests are offered on demand, and publications on the subject are available for consultation at the botanic garden's library. With its public dimension, scale of successful propagation, and rigorous protocols, the seasonally dry forest program played a crucial role in the Cadereyta Regional Botanic Garden achieving ArbNet Accreditation (Level II) in 2019.

Mexican Forest Legislation: a Long and Winding Road

The threats to the conservation of Mexican forests are multiple. Historical context and a lack of legislation are determining factors for the loss of forests and the consequential damage to biodiversity. A brief review of Mexican forest history and policy from the previous century will emphasize the need to reinforce tree conservation.

By the early 1900s, no regulations existed for forest management or extraction. Implicit policies of open access to natural resources, paradoxically, led to dispossession and, consequently, to complaints of inequity from small-hold farmers and other rural producers. The most remarkable outcome of the Mexican Revolution was the Constitution of 1917, Article 27 of which grants *"the Mexican Nation ownership of the land and water within the territory."*

For decades, the management of forests fell to the ministries of agriculture, where they were neglected. By the late 1930s, 18 percent of forests had been distributed to peasants, who were uninformed about legal limits on the extraction and processing of forest materials. In 1940, a new Forestry Law reaffirmed the value of forests. Lumber concessions were awarded by the federal government, but did not produce hoped-for results, as many small-scale efforts ended in closures and bankruptcies, and inefficient operations had negative impacts on the forest. Nevertheless, community participation may have led to an increased awareness of forest resources and the importance of conservation. Through subsequent logging bans, a conservationist approach began to emerge across the country.

In the 1970s, Mexican agricultural policy included aggressive removals of forest tracts. By the 1980s, 80 percent of Mexican rainforests had disappeared. By then, regional community alliances were emerging, claiming control of forests. In the 1980s, forestry development objectives called for dismantling quasi-governmental forestry companies and promoting community-based forest enterprises in their stead. Recent reforms to the Forestry Law have outlawed forest concessions and recognized the rights of communities (1986), promoted community access to products and markets for technical forest services (1992), and pushed large-scale forest plantations (1997). Moreover, since 1994, the Ministry of Environment and Natural Resources has been responsible for the administration of forests. By that time, Mexico had already signed the Convention on Biological Diversity and engaged internationally on topics including biodiversity, conservation, and sustainable use of forests. Since 2012, the Mexican Strategy for Plant Conservation 2012–2030 (*Estrategia Mexicana para la Conservación Vegetal,* EMCV), drafted in line with the UN Convention on Biological Diversity's Global Strategy for Plant Conservation, has been implemented across all member sectors, including the National Forestry Commission.

An Intersectoral Coordination Committee comprised of public and private members monitors compliance with the EMCV, among whose chief objectives is the improvement of the conservation of plant diversity. One of the specific goals in this context is the strengthening of living collections in botanic gardens and arboreta.

Not Enough Arboreta, nor Data About Them

Today in Mexico, there are approximately 90 institutions identified as botanic gardens, most of which have trees in their living collections. However, only twelve specify having an *Arboretum* or a distinct section devoted to trees. Furthermore, the scope of their specific efforts around tree research, propagation, and ex-situ conservation is not well documented.

Five institutions explicitly identified as arboreta exist in Mexico, unevenly distributed across the nation and not organized as a group. It is very difficult to find information about their history, objectives, and progress. This lack of information and action must be addressed through an integrated scheme. The model described above, developed for the trees of the seasonally dry forest of the *Bajío Mexicano*, offers general principles for aboriculture in Mexico: identifying the most important species to be preserved and propagated in a living collection, and documenting the most appropriate methods for their propagation. These can be adapted to other threatened forest vegetation in different regions. We aim to help the ex-situ preservation and sustainable use of native tree species for several purposes: in-situ recovery of patches of a natural and very rare vegetational community, urban gardening and reforestation, ecological restoration, and finally, raising awareness of the importance of native trees. It is crucial to identify threatened species to bring into cultivation in botanic gardens and arboreta close to their distribution sites, and to institute training programs to reinforce propagation schemes, conservation, and propagation of under-represented species and families. Taken together, these measures can advance ex-situ living collections in Mexico.

In Mexico, the Preservation of Trees Still Takes Time and Effort

The legal framework and infrastructure for the conservation of plants in Mexico took a long time to develop. Nonetheless, legislation has emerged and strengthened over the years, and today, we have domestic laws and internationally binding regulatory and reference agreements. Despite this, the Mexican government has not formally recognized the living plant collections of botanic gardens and arboreta in official figures for plant conservation.

The support and recognition of the entire system of living collections—botanic gardens and arboreta—is essential for the general conservation of plants and diversity. By 2030, The Mexican Strategy for Plant Conservation aims to keep 100 percent of threatened species in ex-situ living collections and implement cultivation programs for 90 percent. In 2020, however, the numbers suggested that progress is not moving at a pace sufficient for the conservation of threatened species (with only 52 percent represented in ex-situ collections) or propagation (with only 23 percent under active propagations and cultivation programs), and that there is an uneven distribution of threatened families and species. It is not unusual to overrepresent specific taxa and groups in living collections. Now that we have identified relevant species of trees among those underrepresented and under-cultivated, we can take steps to address the deficit.

In addition to sturdy global arguments for environmental conservation and biodiversity to fight against climate change, there are historical reasons to strengthen Mexico's living collections of plants. Their planning, construction, and maintenance require significant mobilization and displays of resources, labor, and long-term commitment. However, the reinforcement of our botanic garden and arboretum communities is essential to in-situ conservation efforts and goes beyond investing in the present and future. Querétaro's seasonally dry forest is only one of Mexico's many endemic floristic communities. As the Cadereyta Regional Botanic Garden has shown, regional efforts can play a crucial role in ex-situ conservation, horticultural knowledge production, and public consciousness. It's imperative that such regional efforts scale nationwide, and beyond. Every effort to understand, preserve, and cultivate this precious biodiversity is essential.

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Young trees grow and mature in individual containers at the Wild Plants Propagation Unit of the Cadereyta Regional Botanic Garden.

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Sakura Storytellers

By Izzy Acevedo

> *There are dead bodies buried under the cherry trees!*
> *It's true, I swear. How else could they flower that beautifully? That unbelievable beauty made me uneasy for a couple of days. But now, finally, I get it. There are dead bodies buried under the cherry trees. I swear, it's true.*
>
> —Motojiro Kajii, "Under the Cherry Trees" (trans. David Boyd)[1]

Exposition

Snapped branches at either end of a century; a stretch of bark once elegantly carved out in ridges and dappled with lenticels, now hacked and cracked into splinters, trunk cut off at the waist to reveal the heartwood within. The cherry-red of shorn wooden vessels carrying centuries of watery memory.

This is how sakura came to me in a shadowy hour, deep in the bitter chill of winter and the crushing gravity of the pandemic, buried beneath mounds of mourning and morbidity. Amid a breakup with my thesis advisor and a breakout from the confines of a single discipline, the trees

Above left: Joy Cummings examines a Japanese cherry tree cut down in view of the newly-completed Jefferson Memorial, December 10, 1941. *AP Photograph*

Above right: Cherry tree vandalized outside the Japanese Cultural Center in San Francisco, January 2021. *San Francisco Chronicle/Hearst Newspapers via Getty Images*

called out to me in a headline and a photograph, demanding that I pay careful attention to the stories etched into their bark and ripped into their rings. They played me a quiet symphony of multispecies memory and wisdom.

On December 8th, 1941, the day after the Japanese bombing of Pearl Harbor and US entry into WWII, the cherry trees of the Washington, D.C. Tidal Basin were violently broken and vandalized with the words "To Hell with the Japanese." The trees had been given as gifts by the Japanese government thirty years prior and planted as seeds of peace. This intense anti-Japanese sentiment marked in wood would ultimately burgeon into the imprisonment of 120,000 Japanese-Americans in internment camps from 1942 to 1946.[2]

Eighty years later, in January of 2021, a hooded vandal appeared outside the Japanese Cultural Center in San Francisco and viciously snapped the branches of several cherry trees planted around the building.[3] Though threatening in its symbolism, this event paled in comparison to the anti-Asian violence and hate crimes occurring frequently around the country at the time, a symptom of the xenophobic panic surrounding COVID-19.

With these images of hatred and violence hacked into bark, sakura revealed itself to me as a marker of geopolitical chaos translating into violent racism and xenophobia. I was called to go beyond my study of the flowering cherry at face value, called to pay close attention to the tree's resonance through the bounds of time and species, the common threads of history bound by its branches.

Sakura (さくら/桜) is just one of many names for flowering cherry trees. I have tangled with them often along the timeline of my life. I met "sakura" first as a child, regaled with flowery dreams as my parents planned our springtime trip to D.C., only to find that we had missed their transient bloom. Next as a preteen, poring over ink drawings of a Sakura with the pink-petaled power to alter universes. As a tired teenager visiting Kyoto, walking pebble paths and staring watery-eyed at the weeping branches above—and as an adult not much older but a few lives wiser, guided by mentors and ancestors into taking the trees as my teachers, opening my roots and branches to unlikely storytelling companions.

My study of cherry trees grew from prior research on the phenology, or timing of life stages, of native and non-native plants. Using historical collections

and other observational databases, I worked to understand how phenology has been impacted by the intersecting issues of climate change and species introduction, under the mentorship of plant ecologist and biological invasion specialist Sara Kuebbing. Hoping to continue investigating these questions for my senior undergraduate thesis, I took Sara's suggestion to look into cherry trees. It was the beginning of the fall semester, 2019, when my father's funeral hymns still echoed in my ears and the words COVID and "China virus" were faint on the horizon.

I was awestruck to find that cherry blossom flowering has been recorded in detail for over a thousand years. In an incredible dataset from Yasuyuki Aono et al., flowering times for cherry trees in Kyoto dating back to the year 800 A.D. were compiled from meteorological monitoring, imperial records, diary entries, and poetry. Their analysis revealed that in the past thirty years, the cherry blossoms have bloomed earlier than ever before in the past twelve centuries, marking the disproportionately rapid warming of anthropogenic climate change.[4] The population in Washington, D.C. has also been well-recorded over the last century, revealing similar shifts to earlier flowering with warmer temperatures.[5]

In this way, cherry blossoms serve as a well-known and well-documented environmental indicator. With a brief, breathtaking, and bountiful bloom, they have long been the object of veneration and appreciation in cultures across the world. The ancient Japanese were some of the first to watch sakura, which they saw as the seat of the mountain deity of rice paddies and a conduit for the souls of the dead to pass from this realm.[6] Through this they came to understand the trees and their flowers as markers of both seasonal and spiritual cycles, looking to the timing of cherry blossom bloom to mark the coming of spring and to forecast conditions for the autumn rice harvest and the length of winter.[7] This reverence and regard for sakura remained despite the physical, social, and geopolitical transformation of their environments: *hanami,* or cherry blossom viewing, began as a ritual in honor of the sacred cycles of life and grew into the countless modern celebrations seen around the world today.[8] The rush of millions of hopeful viewers and festivalgoers chasing falling pink petals now figures heavily into springtime tourist economies across Japan as well as in cities from Washington, D.C. to Auckland, Hamburg to Busan.[9]

All cherry trees flower, and even those not commonly celebrated as cherry blossoms have often been planted for their elegant flowers and the other useful qualities of their fruits, shoots, roots, and bark. Sweet cherry (*P. avium*) was used in ancient Southeastern Europe for food and medicine, and several species of 사쿠라나무 (*sakuranamu*) were used in Korean folk medicine to treat asthma, allergies, heart failure, and other ailments.[10] Black cherry (*P. serotina*) was also used by many American Indigenous nations for food, medicine, and woodworking, including the Cherokee, Potawatomi, and Shinnecock peoples.[11] The species was brought to Europe as an ornamental in the early 1600s but ultimately became of interest for timber production, widely planted for its ability to grow fast and well even on poor soils; later, however, it was noted for "aggressive invasiveness" when its popularity among seed-dispersing birds and mammals led to spontaneous spread.[12] As such, cherry blossoms have appeared at places of tension and transformation among living things in diet, medicine, and ecology.

Indigenous uses of flowering cherries were typically matched with a view of the trees as spiritual intermediaries between life and death, seen in Cherokee teachings of the reciprocal relationship between humans and life-giving trees as well as in the funeral rites of early Mesolithic Europeans.[13] Across three continents, cherry trees and their offerings to humans were treated with reverence, understood as markers of transformation in life at the level of cells and organs as well as in multispecies relationships. In the many societies where they appear, these trees have imparted healing and nourishment as well as wisdom about the turning of the universe.

Sakura have watched over us for centuries, grown through the birth and death of peoples, places, and powers. These exceptional plants have long shaped and symbolized the way that people view and interact with their world, and as they adapt in meaning, they tell an intricate story of how relationships among humans and nonhumans have shifted over time and space. Their symphonic record of transformation and renewal includes the capture of growth, destruction, and chaos in rich multispecies environments.

> *It doesn't matter what kind of tree it is. When its flowers are in full bloom, the air is infused with a sort of mystic energy. It's like the perfect stillness of a well-spun top, of the trance state that comes with any virtuoso concert—a hallucinatory halo of feverish reproduction. It's a strange, vital beauty that never fails to pierce the heart.*
>
> —"Under the Cherry Trees"

Utawaga Hiroshige (1797–1858), Evening Glow at Koganei Border. *Metropolitan Museum of Art, Henry L. Phillips Collection*

Development

The storylines surrounding the introduction of species to new regions of the world are as twisted and tangled as their paths overseas. For decades, the appropriate classification and treatment of species known as non-native, introduced, or invasive has been hotly debated among scientists, legislators, and even gardeners. The movement of plants between regions has often involved multiple actors and intentions, garnering many different attitudes—much like the migrations of humans.

Black cherry was not the only *Prunus* species to experience shifts in both environment and public opinion. Sweet cherry was carried by colonists from Europe to North America around the same time, alongside sister species tart cherry (*P. cerasus*), both of which would be planted in gardens, farms, and roadsides until shifting into widespread commercial fruit production in the late 1800s.[14] Though cultivated throughout the northeastern colonies and later brought to the west in another wave of colonization, this "wild cherry" is now condemned as an invasive threat in the United States.[15] Like other plants listed as "noxious," broadly defined as "competitive, persistent, and pernicious," sweet cherry is said to displace native species with similar habitats and to serve as a host for pests and diseases.[16]

Wild and native; noxious and pernicious—terms used to describe plants and their habitats come bearing moral and political meaning. Encountering the biology of introduction and migration in coursework, I already knew how laden these questions were, and how they cried out to be contested. I knew that the ecosystem in the era of early botanists and collectors, concurrent with the oppression and brutalization of Native peoples, could not reasonably be called a "native assemblage," much less a pristine biome, free from human influence. I knew that the meanings of "native" and "non-native" were not strictly scientific, but rather made and constructed by the holders of land, power, and knowledge. We might better term this system a biology of transition and consequence—an environment in an unprecedented state of flux after rapid colonization. These ecologies were defined by the disruption of an intricate web of relations once maintained by Native peoples, a kind of stewardship suppressed but not silenced by colonial violence. It was a dynamic system such as this into which sweet cherry was planted and from which black cherry was taken.

These invasive species shared something deeply woven into my history, perhaps even my blood and body, threaded together by our paths between lands.

Yet these nuances were conspicuously absent from conversation in class, with no mention of this blurring of lines in the histories and language of introduction. My feelings of discomfort blossomed into latent rage as I sat in a discussion section and listened to my exclusively white classmates, led by our white, male professor, carelessly toy with the fraught politics of invasive species. I could only wince as I imagined how their ruthless words about non-natives might sound if "plant" were replaced with "person." When I finally spoke up, decrying the xenophobic narratives and violent language surrounding the early movement against invasive plants and animals, I found I was fighting back furious tears.

Was my own life not defined by the experiences of myself, my family, and my people, who too have been intermittently treated as exotic prize and invasive pest in this land of promise? Was I not as foreign as any tree of heaven or Chinese tallow tree seeded and grown here in America? Perhaps the brutal methodologies of control and suppression, varnished as they were with the academic jargon of a science said to be about preserving life, reminded me just a little too much of an immigration tirade online—or even a mid-20th century wartime call to blanket Asian landscapes with fire and toxin, or the longer and more insidious history of forcible sterilization of Black, Brown, and Indigenous people. My white American peers, these kids whose ancestors came with the same rags but rose to different riches, couldn't seem to understand how the early invaders who desecrated the land and its stewards alike had also written up rules for what kinds of life would be permitted in a blossoming country. Those rules never really changed—only the words.

With this language of invasive species plucking at my own bloodline, I could not help but feel disconcerted by the casual demonization of non-natives. Could no one else hear these chords struck with the dissonance of a rewritten history? Could no one else hear the resonance of these migration stories with those of people like my own family? These invasive species shared something deeply woven into my history, perhaps even my blood and body, threaded together by our paths between lands. I could understand wanting to preserve the native ecology, but it was clear that definitions of native status were deeply impacted by human relations to the landscape at the time of cataloguing, something that had shifted radically as plants and peoples alike moved into it. "Well,

I had invasive trees in my hometown growing up, and I really liked them," said my professor. "I don't think it's a racist thing." I would have laughed bitterly if I'd had the breath. How many white men like him would readily deploy this sentiment, denying underlying racism with the defense that they know and maybe even like a person of color? I'd heard it just weeks before, confronting a young man who called me a racist slur and then proceeded to argue that he couldn't possibly be racist because he dated a Korean girl once. Thinking of that all-too-familiar dismissal, the taste of bile rose into my throat once more. I swallowed it. It tore its way through to the core of me. The application for my research grant was still pending. This professor was influential, and I had been encouraged to seek out his advisory approval. He was an expert in his field, a science bigshot, and I was just some tree-hugging Asian kid with a sensitivity for social justice who had somehow turned up in his ivory tower. Feeling more than ever that I was not *native* to this land, I sank quietly into hopelessness.

That discussion section made it uncomfortably clear to me that the problem of species introduction, like that of climate change, could not be studied in isolation as an issue of non-human ecology. This was not just a conservation movement, but a political force colored by race-based hate, embedded in a network of physical and sociocultural environments. The migration of species between lands was also the migration of species between nations, peoples, and systems of power.

My understandings of these worldly things—movements, environments, networks of people and power—would radically shift over the following months, as the world was rent apart by turmoil, death, and mourning, from the early days of the COVID-19 pandemic, through the murders of George Floyd, Breonna Taylor, and too many more, to the storming of the Capitol Building.

During this time, I peered a bit deeper into the history of my trees, wondering what detail might be hidden beneath the surface of sakura's introduction to the United States. As it turned out, the language of invasive species discourse, which had so strongly reminded me of anti-immigrant hate speech, was born alongside legislation like the Chinese Exclusion Act and the Asian Exclusion Act, regulations wrought with racism and xenophobic panic following the influx of Asian laborers in the early American industrial age.[17] And while the sakura of D.C.'s Tidal Basin were intended as a gift of peace from an East Asian nation—an offering of soft, pink-petaled Asian femininity to offset the foreign masculinity of immigrant miners and railworkers—the first shipments of trees were burned in massive bonfires to eradicate stowaway pests like scale and root gall.[18]

After their planting, public opinion of Washington, D.C.'s cherry trees shifted periodically. Women were integral to the continued presence and growth of these sakura—from the initial vision and passion of Eliza Ruhamah Scidmore; to the orchestration of the gift through First Lady Helen Herron Taft and Viscountess Chinda, wife of the Japanese ambassador; to the later protection of the trees from uprooting by women like Eleanor "Cissy" Patterson, who chained themselves to the trunks during the Cherry Tree Rebellion of 1938.[19] Despite avoiding transplantation for a slaveowner's memorial at this time, the trees were not able to evade the violence of war over the next decade, becoming an outlet for racially charged fear, rage, and hysteria. In peacetime, the cherry blossoms would again become adored for their hopeful symbolism and celebration of multicultural community.

By the 1970s these cherries were facing disease, damage, and decay, persisting only with the care of Roland Jefferson, first African-American botanist at the United States National Arboretum. Noticing the cherry trees in decline, Jefferson propagated over one hundred trees from cuttings of the original gifts, effectively preserving the collection. Many of these cuttings were given back to Japan, part of Jefferson's ongoing efforts for the exchange of plants, which would later include a collecting trip and a program trading cherry seeds for American dogwood.[20]

With sakura's buds brushing at the edge of my awareness, I could not help but see the migration stories of my flowering cherry species in a new light. I saw the sweet cherry tree, carried across the sea to make fruit for the colonists who brought death, disease, and disruption; I saw my mom step out onto the tarmac in New York City with a hundred dollars in her pocket, Chinese hands poised with Filipino training to save American lives. I saw black cherry, sought out for its efficient work but denounced as aggressive invader when it made new roots and branches; I saw my mom lauded as the pinnacle of the American Dream and just as soon disrespected by the white men who refused her a seat at the table and a slice of the pie. I saw *somei-yoshino* and *kanzan* carrying the hope of women, immigrants, and minorities on their branches, and I felt the weight of my mother's dreams

built into my own aching shoulders.

These parallel histories of plants and people took the forefront of my independent study presentation that winter. My data seemed to demonstrate different responses to temperature and precipitation in different regions, but statistics aside, something about the interpretation just felt lacking. In my eyes, the trees must be reacting to more than climate and continent alone, because it was their multispecies interactions that really determined how they were moved, planted, observed, and recorded. I was looking for a countermelody between those sloping lines, making narrative of what might otherwise be background noise in the question of how flowering cherry trees responded to the environment. It didn't quite occur to me that my new approach might not be considered a valid way of answering this question.

My advisor was quiet for the duration of my presentation. At the end, he gave me an incomplete grade and asked that I spend the winter break gathering my materials to show that I had done a semester's worth of rigorous *scientific* work.

> *Roots cradle the bodies like gluttonous octopuses; tangles of root hairs, like sea anemone tangles, suck up the fluid. What makes those petals? What makes those pistils? I can almost see the silent ascent of crystal liquid coursing dreamily through those veins.*
>
> —"Under the Cherry Trees"

Cadenza

In that moment I was once again an invasive species, stubbornly seeded among the hedges, scraggly and out of place no matter how well I grew. I felt the noxious spray of his disapproval wither my leaves and shrivel my stems. I saw my body torn and trampled, poisoned and burned, cracked and hacked away.

I was horrified and offended that he thought I hadn't done the work—couldn't he see that I was onto something, desperately digging to unearth a deeper story, fighting to find the words for the narrative underlying the data? I felt so sure of the power of those connections just beginning to weave themselves together, so certain that something was emerging from my obstinate attention to the cultural significance of this indicator plant. There was a reason I sacrificed half of my presentation time talking about history and *hanami,* neglecting to dive into the data I had in fact collected. I just couldn't name it yet.

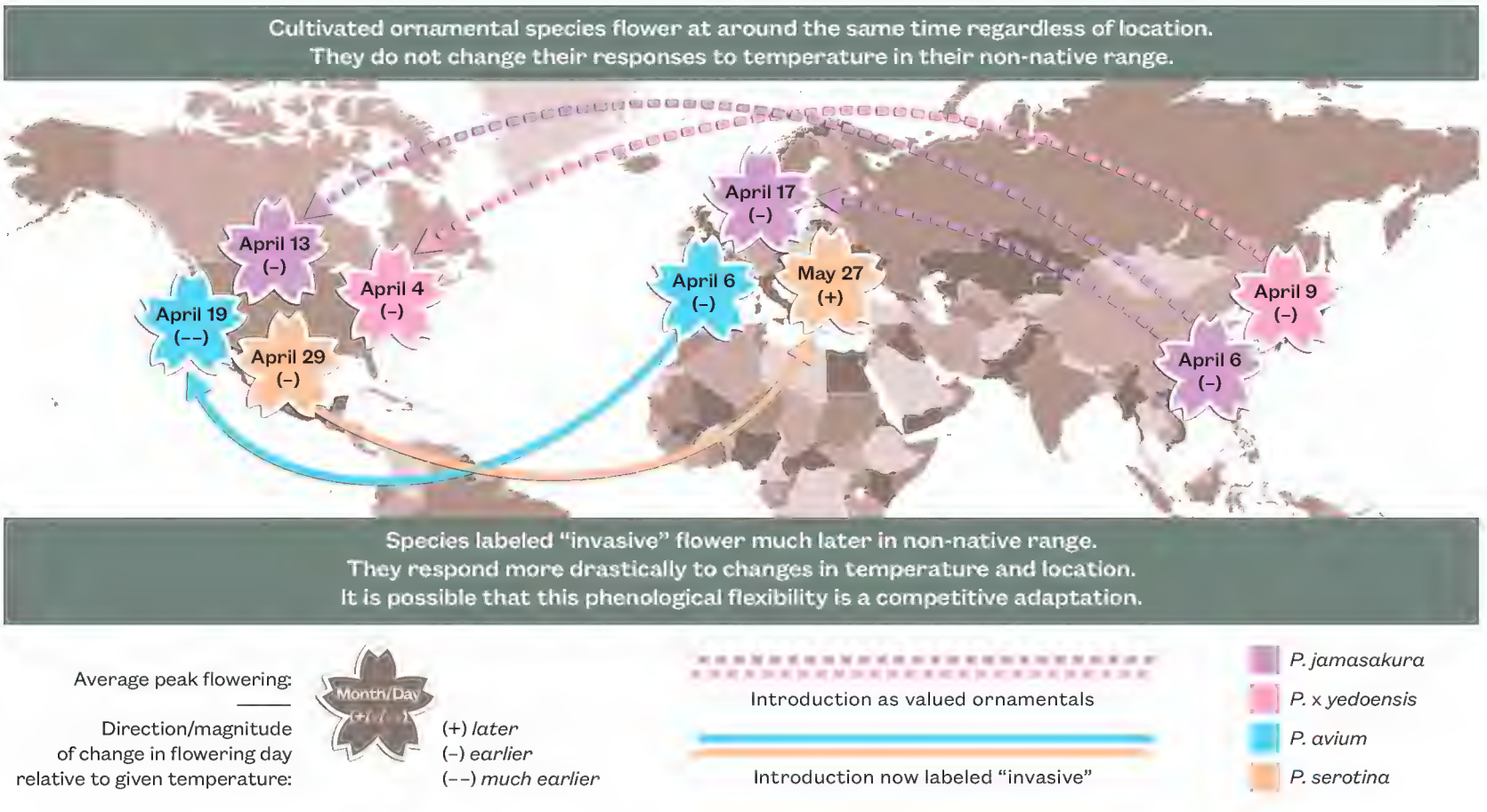
I stared at the outline of sakura on my screen and saw nothing but shadow. Here was a map of how my four flowering cherry species spread across the globe, a set of graphs showing how each population shifted its flowering over time and with increasing temperature—a rhythm straining to rise out of the mess of metadata and code I'd compiled—yet those rigid lines and fat dots failed to capture the interwoven histories of moving plants and humans. I turned to my browser and did a basic Google search for cherry blossoms, grasping wildly for new ideas. And that's when sakura snared me with a headline and a jagged stump of cherrywood flesh: *I see you,* it said, in the language of anguished splinters beige and red. *Me too.*

Sakura and I shared in a kind of pain that traversed time, worlds, and species, bubbling up in bloody storylines bound and tangled together—bloodlines, resonating with more-than-human memory. It reverberated from those Japanese cherry branches in California to my Filipino-Chinese guts in Rhode Island, to the European sweet cherry called a weed in Maryland, back half a century to the mutilated sakura on the D.C. Tidal Basin. The same traumas that threaded back through generations of my ancestors also ran between organisms and their own histories, bloody storylines bound and tangled together—bloodlines. Just as sakura was desecrated in reflection of violent racism, my own body was ravaged with an unspeakable agony back then in that classroom, and now again at my computer in indication of those same undercurrents. Just as sakura strained to move and shift with a spiraling climate and an unwelcoming new home, I struggled to contend with my fear in the face of the same oppression. And just as sakura blossomed to reveal the bloodstained history seeping up from its roots, I too blushed with defiance as I leaned into the strong, ancient bark of this new flowering ancestor.

> *Why the pained look on your face? It's a beautiful vision! Now I can finally train my eyes on those flowers. I'm free of the supernatural force that has been haunting me.*
>
> —"Under the Cherry Trees"

Refrain

It was simple enough to compile the data that proved my efforts at scientific inquiry, resolving my grade for the semester. I followed up by notifying my professor that I would be shifting to a new advisor for the remainder of my thesis work, investigating the intersections of environmental and social change I saw in sakura's multispecies entanglement. Environmental historian Bathsheba Demuth is best known for her work telling transformative stories of change,


Cultivated ornamental species flower at around the same time regardless of location.
They do not change their responses to temperature in their non-native range.
April 13 (–)
April 19 (––)
April 29 (–)
April 4 (–)
April 17 (–)
April 6 (–)
May 27 (+)
April 9 (–)
April 6 (–)
Species labeled "invasive" flower much later in non-native range.
They respond more drastically to changes in temperature and location.
It is possible that this phenological flexibility is a competitive adaptation.
Average peak flowering:
Month/Day
Direction/magnitude of change in flowering day relative to given temperature:
(+) later
(–) earlier
(––) much earlier
Introduction as valued ornamentals
Introduction now labeled "invasive"
P. jamasakura
P. x yedoensis
P. avium
P. serotina

Cherry trees generally flower earlier in their native range, regardless of the path of introduction. Of the four species under study, the two listed as "invasive" show greater sensitivity to introduction and climate change. Phenological flexibility could indicate a plant's ability to escape human cultivation and naturalize in new environments.

consequence, and contingency in Beringia; with the power to find the judgements of whales in archived ship logs and sailors' diaries, she is well-versed in the art of paying attention to ripples under the surface.[21] With the urging of Bathsheba and sakura itself, I finally knew the question at the core of my work: the question of cherry blossoms as indicators of more than the physical—of environments human and non-human and more-than-human, social and cultural and political, natural and artificial and ecological. I would weave something new with these stories, drawing on the threads of Donna Haraway's tangled more-than-human string figures; of Suzanne Simard's mycorrhizal knowledge networks; of Anna Tsing's polyphonic arts of living and dying; of Alexis Pauline Gumbs' love for all kinds of watery kin.[22]

I began with the cherry blossom phenology data I had so painstakingly collected, drawing from scientific repositories as well as other archives just beginning to prove themselves useful for scientific study. Gathered into one laptop-slaying dataset was flowering information from phenology databases and occurrence records, meteorological and parks services logs, and previous studies like the Aono et al. work, as well as data I had collected myself by visually assessing images from digitized herbarium specimens and community science observations. This time I would use the statistical power I had assembled to ask the kinds of questions that could make these endless grids of numbers into multispecies storylines.

Considering each species' history of global introduction as well as changes in temperature and precipitation, I determined that cherry blossom flowering shifted in response to both climate change and migration. Each of the four species reacted to climate as expected in their native ranges, flowering earlier with rising temperatures, and these effects were altered predictably in new landscapes. On every continent where they appear, these cherries were accelerating flowering by as much as 3.5 days per °C, a conservative estimate relative to other findings but still corresponding to a 2-week advancement by 2050; such shifts could be enough to trigger ecological and physiological constraints posed by earlier timing relative to frost dates and the life cycles of pollinators and dispersers.

Armed with new understandings of how my study species have interacted with humans and nonhumans over time, I saw how the crisscrossing lines

High school girls waving farewell to a *tokkotai* pilot, photograph taken April 12, 1945. *Public domain via Wikimedia Commons*

of model results over seas of dotted observations might also reflect the paths of shipments and immigrants across oceans. I found that differences in this flowering response corresponded to differences in the non-native classifications of each species, pointing to flowering as a potential indicator of this status. The two species considered invasive showed great sensitivity in both flowering day and climate response when introduced to new environments, reacting to temperature, precipitation, and location, while the two prized and carefully cultivated as valuable ornamentals had significantly reduced responses. I could imagine that phenological plasticity—the capacity to shift with changes in the environment—would be found in species able to form naturalized populations unassisted, an ability that might be lost if a species were to come to rely on humans for cultivation. As such, phenological plasticity is a potential adaptation that could indicate how a cherry tree species was received in its human environment. When I asked the questions shown to me through sakura's bloom, those charts, which had once felt so empty and inconclusive, could finally tell their stories, tales of rich interspecies relationships shaped by the agencies of both humans and trees.

Reading between the lines of my scientific analysis and the history drawn up for me in vandalized bark, I could finally see that the shape of the question you asked was determined by the framing; that the weight of the histories rested on how deep into the archives you dug; that what you saw in the sakura depended on your lens. I realized that the stories sakura told through these databases and archives were only possible because they have watched over our more-than-human worlds through geologic time. They were in tune with a larger symphonic whole, responsive not just to warming climate, but to the ebbs and flows of more-than-human power dynamics. By watching the sakura in careful, thoughtful new ways, inspired by their own practice, I learned how to look more effectively. Sakura and I became storytellers together through this relationship of reciprocal regard and response.

What I found was that through history, more and more came to watch the flowering of these trees as they inhabited new symbolic spaces—in the nationalist sentiments of feudal lords and fighter pilots, in the subtle subversions of gender-bending geishas and pink petal pageant princesses, in the bitter violence of war and colonization. Through the unprecedented

forms of movement and change created by modern globalization, sakura was brought into new and distinct encounters with humans, deeply entangled relationships, which reflect underlying shifts in social structures, geopolitical systems, and multicultural relations. These trees traveled the same paths as people and watched histories unfold from all over the globe.

In their transience and transformation, cherry blossoms have intermittently been emblematic of war and peace, colonization and freedom, normativity and subversion, and racism and multiculturalism. For example, sakura became strongly associated with Japanese identity partially as an attempt by Japanese aristocrats to distinguish themselves from the Chinese colonial elite, who gave high regard to the plum blossom.[23] But while the ancient spiritual understanding of cherry blossoms lent itself to symbolism of the Japanese soul, the flowers also took on connotations of military power and political nationalism.[24] During the brutal occupation of Korea as well as parts of China, plantings of Japanese cherry tree varieties served as a marker of colonial rule and cultural domination via the landscape.[25] Later, in the transformative global turmoil of WWII, the Japanese military would weaponize the aesthetics and sentiments of sakura in their calls for *tokkotai* pilots (often called *kamikaze*) to plummet to a fiery death for their nation and emperor, bodies scattered like falling petals and souls reborn in the springtime bloom.[26]

These trees traveled the same paths as people and watched histories unfold from all over the globe.

With these new understandings of the cherry blossom's story fresh at heart, I saw something bloom up through the data again, this time in an analysis of *P.* × *yedoensis* temperature responses by country. Noticing that the species exhibited a significantly reduced response to climate in Korea compared to Japan, China, and the United States, I found a paper by Myong-Suk Cho et al. that detailed controversies over the tree's origin and presence in Korea. While *P.* × *yedoensis* was planted by the Japanese during the colonial occupation of Korea in 1910–1945, these scientists used molecular evidence to differentiate the disputed hybrid from the morphologically similar variety classified as *P. yedoensis* var. *nudiflora* which grows natively on Jeju Island.[27] It is possible that their differences appear not only in genetic markers but in their phenological plasticity relative to shifts in environment, obscured by the single Latin name with which the phenology data was originally recorded.

Composing stories through my carefully collected data, the sakura taught me here to look deep into the names and classifications given to them by people around the world. The controversy over *P. yedoensis* and *P.* × *yedoensis* was just one hitch in a broader movement to categorize all life into a single taxonomy, a language of the powerful, in which the nuances of local knowledge and experience in naming became lost or obscured. The work of reclassifying and gathering plants, like that of the Arnold Arboretum's own famous collectors, has brought us the joy of appreciating these trees in our nearby landscapes but also served to muddle the narratives of how people have interacted with them over time. It was the distinctions in flowering times *within* this generic classification that indicated to me the presence of an important underlying thread.

With this in mind, I looked beneath the Latin to sakura's many names. To its hundreds of variants in Japanese, where subvarieties unnamed in English are given the individuality of a species, like the *ukon* ("turmeric") with its curry-colored flowers and the *fugenzou* ("Fugen Bosatsu elephant") with its large, pale blossoms holding pistils like bodhisattvas on their backs. To the dozens of names in the hundreds of languages of American Indigenous peoples, made not for the "species" but for the ways people interact

with fruits, flowers, roots, and bark—like the Gitxsan word *eluuts'ook'* ("makes your mouth smooth so nothing can slip on it") or the Upriver Halkomelem *łəəxw łəə́xw* ("spit out many times"), or the Okanagan words for related varieties like *sk'eluʔsáłq* ("old spring salmon fruit"), *stepłxiyáłnexw* ("covered away from the sun"), and *nts'ew'ts'ag'w-wísxn* ("tasteless").[28] To the handful of cherry trees named in English, words like "bird," "mountain," "wild," and even "oriental" speak of much more than the trees themselves. As I learned, flowering is just one of the many ways in which these exceptional trees reveal their responses to changing more-than-human environments over time and space.

There are myriad ways that a human can view a cherry blossom and a cherry blossom can view a human; how much more possibility do we unravel when we imagine the narratives of a pollinating insect, a dispersing bird, an herbivorous mammal, a fungal decomposer? Sakura invite us to question the view from our place in the more-than-human environment. They teach us new ways of confronting sticky entanglements of the natural and cultural, guide us into new imaginaries for knowing and learning across disciplines, pull us into new perspectives as these intersectional environmental issues demand. Taking trees and other human and non-human familiars as our unlikely teachers, we can grow into the rhythm and harmony of symphonic multispecies being.

> *Yes, dead bodies are buried under the cherry trees! Dead bodies. I have no idea where the idea came from, but they've become one with the trees now. No matter how hard I try to shake this fantasy from my head, it just won't let me go.*
>
> —"Under the Cherry Trees"

Coda

I remain a devoted student of the sakura. In watching them with thoughtfulness and care, taking them as storytellers, teachers, and keepers of memory, I am guided into new understandings of the powerful transformation within our more-than-human environments. Beneath the pink-petaled splendor of their branches, I will always find new strings to follow among the knots and tangles of shared history.

Inside the Arboretum's greenhouses at Weld Hill, I spend the hours nurturing phlox—American wildflowers quick to grow big and bushy, spewing clouds of vivid yellow pollen. My body reacts to them with the need to expel and escape, eyes watering and chest heaving with sneezes, a physical rejection of the greedy enormity we coax into their flowers with canned fertilizer and electric lights. Perhaps the phlox reject me too, as do their Texan overlords, like the man who talked very casually about shooting me and my companions while we collected seeds on the roadside just outside his fence.

Perhaps the building rejects me, too—and so I felt that first spring, throat and fists and gut clenched tight as I walked through the halls and stared. Stared up into the eyes of the nameless Asian individuals who once helped a collector bring flora into our Massachusetts landscape, whose faces outnumber the Asian personnel who see them. Stared at the labels beside each photograph and willed them to give me more than the careful Latin of a plant's binomial and the bolded English of the collector's name. Stared at a Taiwanese cycad in a pot just below, captured and kept in plastic to pretty our hallways, just like the image of the woman labeled "peasant girl." Stared determinedly past the longtime employee who, after several months of working in the same building as me, mistook me for an Asian caterer who looked nothing like me.

Many of those drizzly days, I found myself floating out of the building and up the slope where the oaks grow tall. Across the street and through the Walter St. Gate, down a shadowy tunnel made by the canopy of yew. Past the Bussey St. Gate, a memorial to a man who made his wealth trading the products of slavery, flanked by sandwich boards showing off the smile-stretched, light-skinned faces of the Arboretum's employees. My feet carried me further, up the Beech Path that cuts across Bussey Hill. In early spring the dewy grass becomes blanketed with electric blue patches of Lucile's glory-of-the-snow and Siberian squill, both non-natives and harbingers of spring, both with tangled histories of naming, much like sakura. I rushed past the *Stewartia*, feeling sympathy for their story—some of these ornamentals hail from East and Southeast Asia like my family, while others are from North America like me. Finally, I reached the corner of the Rosaceous Collection that includes the cherry trees and bent over a low-hanging branch in relief. I found kin in my favorite weeping Higan cherries—whose branches are often grafted onto straighter trunks because of their bent and gnarled backs—trees who know that, after reaching high into the sky, we shouldn't forget to dive deep.

The first day I visited, there were only buds. The third day, I hunted until I found one poking out a

The Cherry Blossom on Rüttenscheider Straße

By Sumana Roy

The poems—Thomas and Housman and Neruda—
lapsed into tourism when I first saw you,
as tall and foreign as the name,
on Rüttenscheider Straße.

Imagine impossibilities,
convicts of the imagination—
the statue of a sneeze,
a hiccup, a fall, a word escaped,
the mind unable to hold it back,
like the earth pulls back the grass.
Fleeting, floating, like a yawn.
Your life, only as long as a clap,
in a world where everything's long,
as long as struggle.

The mumble of shy pink,
the loyalty of softness,
of petals pretending to be strong,
as strong as a vow.
The hamlet of pale flags,
the glance of toothy flowers.
A collective of spring winks.

I remember the voltage—
the lifespan of a blink.

But that is not what I saw.

When I saw you, I saw Time.
Time, our primitive invention.
I'd been counting wrong all my life.
You stood there,
Time bruising your flowers.
You stood there,
keeping time in colour, like aging hair.
I still remember you ten years later,
standing, flickering like impulse,
breathing brevity, skeletons of coral air.

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Cultivar of weeping Higan cherry (*Prunus subhirtella* var. *pendula* 'Park Weeping', accession 412-62*A) on Peters Hill. *Photograph by William (Ned) Friedman*

petal. A few more days saw a single flower, and then another, and then another, and in a few more turns of the earth we were approaching full bloom. The petals floated gently on the air alongside me, soft and delicate, subtly pink and just a tiny bit sweet on the air. With some distance between myself and those echoing halls, wrapped in whispering branches, I finally felt a bit of peace in my breath and blood. By visiting the sakura, and watching other plants on my path the way they taught me to do, I came to understand these resonant tensions in my own body and in the construction of Asianness in my work environment. They showed me how to use myself as an indicator of disharmony, of dissonance, and how to draw out the stories that could bring humans and nonhumans around me into polyphony again.

Soon, the photographs in Weld Hill will bear new labels, telling the story of how the Chinese, Japanese, and Korean people pictured were integral to a collaborative endeavor in plant collection that brought us not just these images, but many of the plants that compose our vast and diverse landscape. They will explain why the white men in charge of these expeditions, as in many others, did not bother to document the local people's names, contributions, or relationships to the land. And change is underway—already, there is at least one more live Asian face in the hallway smiling at me. When my body takes me across the landscape, up the hill, and through those fields of blue, I see that the *Stewartia* are listed as *natsutsubaki* (ナツツバキ) and *nogaknamu* (노각나무)—"summer camellia" and "overripe cucumber tree," names telling stories that tickle rather than burn my throat. I greet the sakura head held high.

If I bothered to pull up the code each spring, my model could predict for me when the cherry trees would be in peak flower anywhere in the world that season, give or take a couple days. But I find that I learn much more about the turning of my world when I watch the plants and let them tell me instead.

> *At last, I feel as if I have the right to gaze up at the flowers and enjoy a drink like the people reveling over there, under the cherry trees ...*
>
> —"Under the Cherry Trees"

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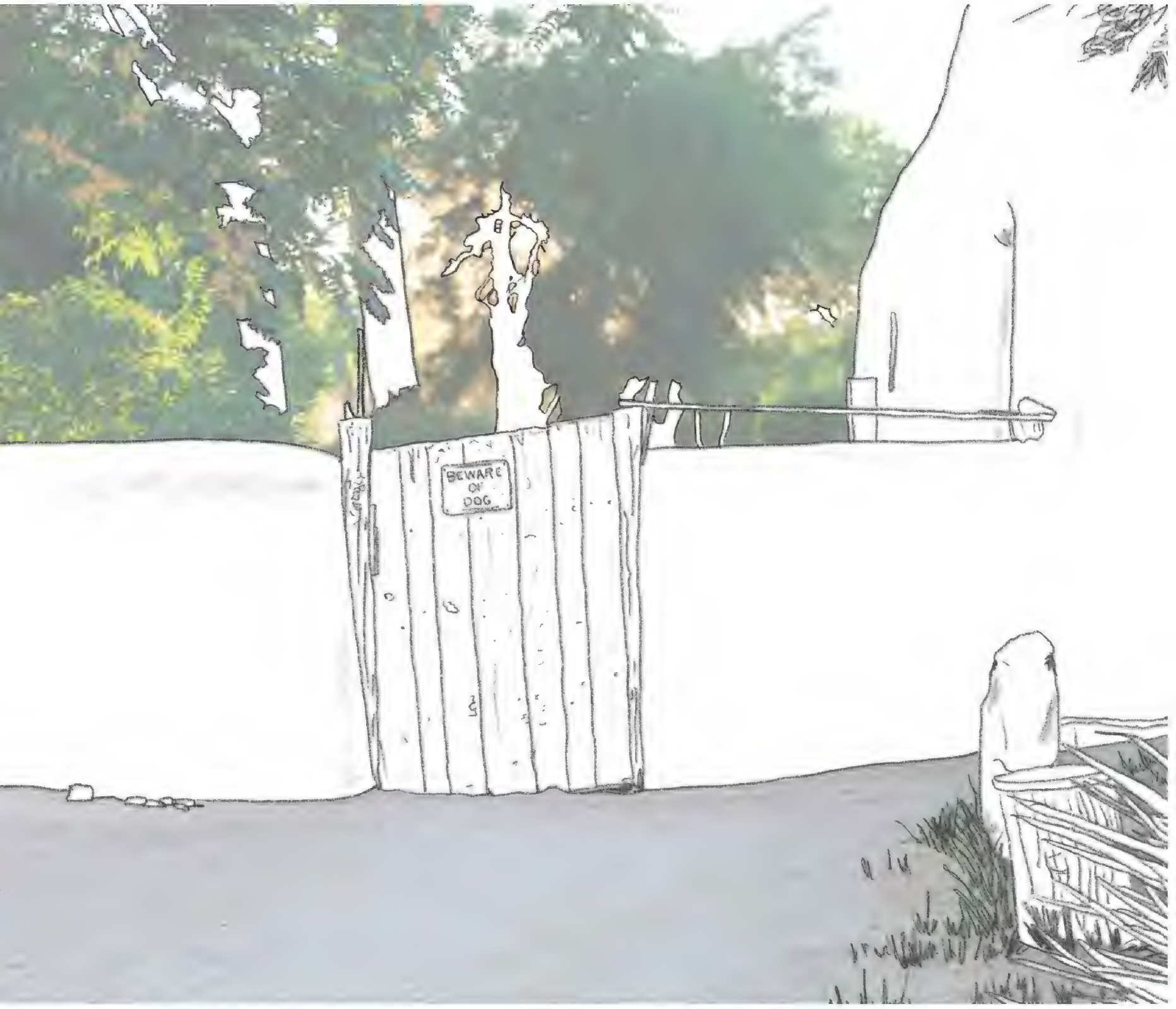
VISUAL ESSAY

Georgia O'Keeffe's Garden as Witness

By Sherri Wasserman



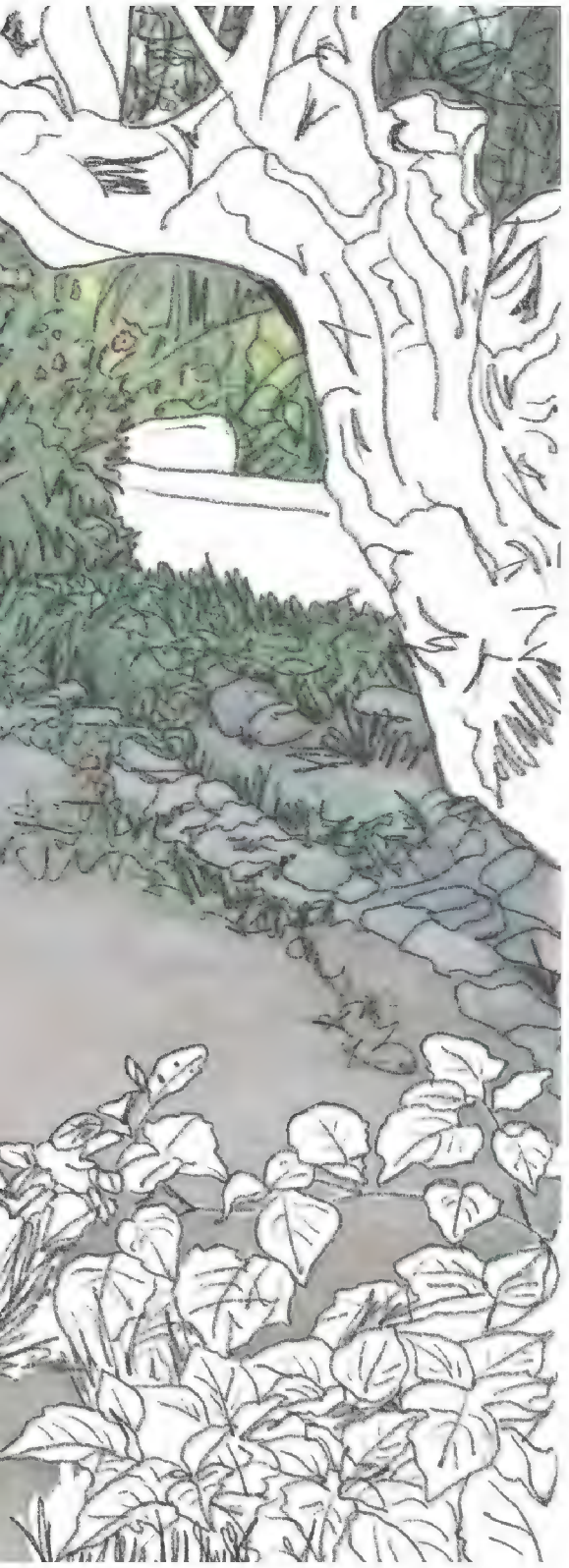
In 1945, Georgia O'Keeffe acquired her property in Abiquiú, New Mexico. Following an initial trip in 1929, she'd been visiting New Mexico regularly since 1934, and had purchased her home at Ghost Ranch in 1940. O'Keeffe claimed that it took her some ten years to acquire the Abiquiú location, which included the remnants of eighteenth-century dwellings and a connection to the local water infrastructure, known as *acequias*. O'Keeffe's friend, Maria Chabot, proceeded to spend four years renovating, building, and planting the site that would become O'Keeffe's home and studio. Within the first years of the Abiquiú renovation, O'Keeffe mostly lived on the East Coast in order to manage the estate of her recently deceased husband, the photographer Alfred Stieglitz. After moving to New Mexico to establish primary residency in 1949, O'Keeffe lived between her Ghost Ranch and Abiquiú homes.

At Abiquiú, trees stand guard both over and within O'Keeffe's compound walls. They surround the garden and appear within courtyards. We can think of these trees as witnesses to momentous changes that occurred throughout O'Keeffe's long lifetime. We can also envision

Above: the gate entry to O'Keeffe's garden is located adjacent to a sign declaring her home and studio a National Historic Landmark.

Opposite: O'Keeffe's home at Abiquiú lies north of Los Alamos, on the road between Santa Fe and Ghost Ranch. *Illustrations by Sherri Wasserman*

A docent describes connections between O'Keeffe's garden and paintings.



the trees as ways to connect the below and above, a continuum of regional histories of which the artist was a part.

O'Keeffe's Abiquiú home and studio is located approximately 50 miles northwest of the New Mexico capital, Santa Fe. It is also situated approximately 50 driving miles north of Los Alamos, a current national laboratory where scientists constructed the first detonated nuclear weapons. The Abiquiú site contains a collection of buildings, a garden—and a nuclear fallout shelter built into the cliff beneath O'Keeffe's bedroom. As with her studio and bedroom windows, the entrance to the fallout shelter looks out over the Chama River Valley. Public tours of the site include the kitchen, inner home courtyard, studio, bedroom, and some additional rooms. Select tours also provide entrance into the fallout shelter. Upon arriving, visitors pass through the compound's modest gate and enter O'Keeffe's garden.

In public and scholarly interpretations, O'Keeffe's home and studio compound evokes mythologies of the American Southwest, the artist's legendary independence, and the Atomic Age. Knowledge of Northern New Mexico further exposes and entwines one to deep histories of cultures and creatures. From the 1920s through the 1940s, dinosaur bones were unearthed not far from O'Keeffe's Ghost Ranch home, as Audrey Goodman reports in *Lost Homelands: Ruin and Reconstruction in the 20th-century Southwest* (2010). The trees don't reach back that far, but they do witness interwoven time frames—of ecological pasts, histories of peoples, the nuclear age, and O'Keeffe's life and legacies.

Given their focus on flora, bones of fauna, and landscapes, O'Keeffe's paintings provide a sense of time and surroundings. However, hers was literally a superficial view, as she explored her world via vistas and detritus found on surfaces of the earth. Her observational acumen may be part of why people pilgrimage to her Abiquiú home and studio—to see what she saw is a powerful draw. Her home and studio structures also hint at a sense of her participation in cultural and environmental histories; the buildings combine architectural bones from the 1700s with mid-twentieth century modernism and twenty-first century conservation efforts.

Cradled by trees consisting of volunteers and old and new plantings, O'Keeffe's Abiquiú home and studio charts some of the ways in which she broke and transcended the surface, as her life incorporated

that which was also in and beneath the soil. Her fallout shelter expresses the anxieties of mid-20th century nuclear developments, while never breaking the view out to the vast Chama River Valley beyond. The shelter is only one piece of her buried critical infrastructure, however; her water system, consisting of traditional *acequia* structures, are hundreds of years old. O'Keeffe was also an avid grower of flora for both beauty and food. Over the four decades within which she lived at Abiquiú, she also turned over Northern New Mexico historical layers of place when she tended her garden.

Throughout O'Keeffe's life in New Mexico, the trees witnessed ongoing impacts of the region's colonial pasts, post-Depression Era mentalities and survival tactics, and both the visible and invisible impacts of the new nuclear age. The ongoing work at Los Alamos has and continues to irrevocably change the surrounding watersheds, farmlands, and forests—as well as the relationships, livelihoods, risks, and worldviews of those who live in nearby towns (relationships vividly traced by Jake Kosek in his ethnography, *Understories*). As anthropologist Joseph Masco puts it, Northern New Mexico ecologies are "mutant," transformed by the logics of the nuclear age: landscapes into parks and preserves, and trees and other living beings into "sentinels" who bear witness to the often-invisible phenomena of "radioactive nature." These mutant natures—trees as living entities affected down to their very molecular structures, now and for future generations—may be invisible to casual visitors to O'Keeffe's Abiquiú home, but that doesn't mean

Visitors ponder O'Keeffe's garden, surrounded by trees that have seen farther.

Opposite: A general site plan, based on archival materials dated 1996.

Visitors pause on the pathway between O'Keeffe's home (right) and studio (left).

that the transformation is not still there. Acknowledging these effects, taking the land into account, as more than a stage-set or symbol, allows us to see histories, presents, and futures more clearly, to engage in what Shiloh Krupar calls a "relational ethics." The land is not just a proscenium, but a pathway to less-discussed stories, and the trees are more than mere background, but witnesses to pasts and futures we may strive to see.

What if O'Keeffe's trees provide us with not only a framing for her surface worldview, but also as entry points to envision a wider context within which she lived? Standing in her garden, surrounded and enclosed by these visual and ecological reminders of continuums, thinking about what they must have encountered—above and below, across their years and hers—allows us to see O'Keeffe as more, and more complicated, than her typical story. To only acknowledge the views embedded within her surface landscapes is to miss the ways in which she, and her home and studio site, engaged with and embodied much deeper times and cultures.

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Propagations

PERSONAL HISTORY

Improvised Landscapes

By Nicholas Anderson

Over the years I have abandoned and inverted my horticultural training, and today, I struggle to describe what I do. When time is short, I simply say that I make meadows with native plants; sometimes I use the term "ecological maximalism." But definitions don't really matter when it's late September, and I'm stopping off at a patch of dirt in Gloucester, Massachusetts, sandwiched between a new housing development and a Market Basket on the edge of a woodland remnant. Just now I don't particularly need any new plants, as I have a dozen or so ongoing meadow projects that double as plant nurseries, but I can't resist a salvage mission before going grocery shopping. I walk past orange-painted surveyors' stakes through one of the spots where I scattered seeds the previous winter. Most of the seedlings have succumbed to the drought, but a few anemic partridge-pea plants (*Chamaecrista fasciculata*) are visible amidst the tire tracks. This space is used as a parking lot for little league games in the summer and the city deposits untold tons of salty snow here every winter. Remarkably, whorled loosestrife (*Lysimachia quadrifolia*) and sweet fern (*Comptonia peregrina*) insist on colonizing into the very spot that gets savaged by the plows year after year. I pull up four rhizomes of the sweet fern and grab two tiny volunteers of winged sumac (*Rhus copallinum*) before heading over to the other side of the lot, where frost aster (*Symphyotrichum pilosum*) and oldfield goldenrod (*Solidago nemoralis*) are in bloom amidst mugwort (*Artemisia vulgaris*) and tendrils of asian bittersweet (*Celastrus orbiculatus*). Out of the midst of these introduced species, I yank up twenty-odd plants with tender violence and put them in a wet, plastic bag.

Of course, I would never think about removing plants from a wild area. Years ago, even taking them out of a parking lot felt sketchy and transgressive, and would trigger the park ranger in my head. But the ranger is long dead, buried by the bulldozers that produce an annihilating revelation of what such land really is in essence: real estate. Now I'm happy to talk to anyone about my practice and to show them how and where to do it responsibly.

I've always looked at the ground. I spent huge swaths of my childhood in the woods of Rockport, Massachusetts, talking to myself while looking for snakes and salamanders. I never found arrowheads or other evidence of indigenous inhabitants, but I found endless numbers of antique bottles and other effluvia from prior centuries emerging from vegetated midden pits. As an adult, I lived for decades in cities, and always had the bohemian-magpie impulse to look at the ground for odd treasures amidst the flotsam and jetsam in the streets: a flattened metal jar lid with the delicate image of a rabbit along with some Cyrillic writing; the hard, plastic head of a toy gorilla with a haunted look. Collecting such sacred objects can release some of the pressure that builds up in the engine of consumerism. They're worthless, and thereby priceless.

I began studying horticulture properly during a three-year stint working for the NYC Parks department and related conservancies. I had been digging in the dirt and playing with plants for a few years prior, but

Illustration by Karlotta Freier

most of my learning had been autodidactic, gathering little snippets of information from family and neighbors together with lazy googling. In spring 2016, it became academic, rigorous, and completely consuming. I was an insufferably eager student.

A global city, New York has been a hub of plant discourse for centuries, going back well before John Torrey and Fredrick Law Olmsted. There are four major botanic gardens in addition to numerous botanical collections throughout the five boroughs, and there's a lecture, symposium, or other such meetup on some aspect of the plant world around every eight seconds. And I took advantage of it all. The book *Planting in a Post Wild World* had just come out, everyone was abuzz about the work of Doug Tallamy, and native-plant community horticulture was ascendant. I saw the light. I saw the logic. I felt the appeal. The professional incentives were palpable. "We can reclaim beauty and biodiversity for our towns, cities and suburbs for all creatures great and small!"

But at the same time, I happened to buy Peter Del Tredici's *Wild Urban Plants of the Northeast,* an essential guide to the flora of the lived environment in our region, which turns the green smear of semi-perception that one has on a walk to the subway into an enchanted treasure hunt that adheres stories, origins, and details to every plant one encounters growing out of the sidewalk. It is also a smuggled polemic that admonishes us not to succumb to the siren song of simplistic binaries like "native vs. exotic," etc., and to interrogate history and its associated land practices as well as the ways that spontaneous urban/suburban vegetation might be providing unseen services that municipalities are unable to address.

At this time, I was working in the dirt by day and returning home to garden in my small yard in Queens—often by flashlight, which inspired my neighbor to call me "the night gardener." I felt like I was carrying Del Tredici and Tallamy in my head above the caption, "Thesis and Antithesis." The former described the world that I lived in with all its uninvited and irrepressible vegetation. The latter described the crystalizing prelapserian ideal as I experienced it professionally, at botanical talks and in conversation with botanists, ecologists, and coworkers enchanted with ideas about "saving nature" by planting native plants.

If asked at the time what should be done to improve landscapes, I might have figuratively gestured towards four centuries of American history and said, "just do the opposite of all of that." But no amount of magical thinking can change the fact that people's minds are now filled with a dissonant jumble of horticultural aesthetics and agendas, and our urban soils are filled with a corresponding profusion of seeds from many parts of the globe, along with construction debris and plastic particulates.

Today, I'm working toward demystifying planting by showing what can be accomplished by simply shoving a bunch of roots and rhizomes of common, native plants into a patch of bare soil, practically right on top of one another. After an hour or so, the dirt looks unchanged, apart from a few new bits of green. It looks even worse in the days that follow, as many of the visible leaves wilt in the sun. With a little watering over the next few weeks, however, the roots take hold, and shoots and leaves start reaching for light. Anyone with a botanical background can explain this process down to the smallest detail with reference to transpiration, photosynthesis, and meristematic tissue—and this knowledge can be entrancing. But I also think there's an opportunity for a childlike re-mystification as the ground in essence starts coming to life.

Having started my horticultural training when I did, I took it as a first principle that gardens should consist of an abundance of native plants as opposed to turf, wood chips, or other inorganic material. And working in landscapes, I was constantly editing and dividing and bringing home little bits and pieces of new species to experiment with. It took very little time before my tiny yard was completely vegetated with an overabundance of plants. But while a square foot of soil in a formal garden might only be occupied by a few plants at the most, in my

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yard there would be dozens, and they could continuously be added or subtracted without noticeable impact.

The first casualty of this process was a carefully designed area in my garden defined by delicate woodland plants, including Christmas fern, Appalachian sedge, and foamflower. The horticultural allure of such species is that they sit in place looking pretty without readily spreading or seeding around. In accordance with my design training, I had arranged the plants in odd-numbered clusters to create a casual, naturalistic effect, but they were quickly inundated by native mints and asters from elsewhere in the garden that spread by seed and rhizome. I could have weeded out the volunteers to maintain the intended aesthetic, but I chose reproduction, abundance, and benign neglect. Any interest I had in rare, specialized, or unusual plants dried up as I became singularly focused on aggressive natives that would produce a lot of seedlings, divisions, and ecological rewards while outcompeting undesirable "weeds."

Using a relentless process of addition and only very selectively subtracting plants from landscapes is like carving with the grain of ecological succession. All conventional planning is delayed until the plants have automated things in a pleasing way through their own growth and reproduction. Instead of a godlike, architectural approach to creating a design to be retained through constant maintenance, suppression, and intervention, this approach acknowledges that land is a time-based medium requiring continual improvisation—ideally guided by the adage, *Yes, and* ... It's less like building sandcastles, and more like working with the flow of a river.

My largest ongoing project started in May 2020, in East Gloucester, Massachusetts, where my friend and collaborator Molly Hardy and I started clearing an egg-shaped crescent of space some 100 feet wide and 600 feet in circumference, separating neglected garden beds from a lovely sliver of woodland dominated by red oak (*Quercus rubra*), black cherry (*Prunus serotina*), and

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serviceberry (*Amelanchier* spp.). This band had become an impenetrable thicket of Morrow's honeysuckle (*Lonicera morrowii*), greenbrier (*Smilax rotundifolia*), and Asian bittersweet, along with some preexisting Arrowwood viburnum (*Viburnum dentatum*), which we left in place. Everything else was manually torn out by the roots, save for some dying trees that I cut to the ground.

As soon as a small section was cleared, we densely and improvisatorially added salvaged roots and rhizomes of native plants with a wide variety of growth strategies, such that they quickly filled the voids that would otherwise be colonized by uninvited "weeds." A few things were purchased, but 99% of the planting comprises exceedingly common species like yarrow (*Achillea millefolium*), wild strawberry (*Fragaria virginiana*), various asters, ferns, violets (*Viola sororia* and *V. lanceolata*), sedges (*Carex* spp.), and goldenrods (mainly *Solidago juncea* and *Euthamia graminifolia*). Most of these were dug out of the lawn and from other areas of the property, as well as

the aforementioned parking lot near Market Basket. We also planted some familiar native ornamentals that I had in abundance, including bee balms (*Monarda fistulosa, M. didyma*), joe-pye weed (*Eutrochium maculatum*), black-eyed Susans (*Rudbeckia fulgida; R. triloba*), as well as the rhizomes of shrubs that can practically be divided like perennials. These include meadowsweet (*Spiraea alba*), summersweet (*Clethra alnifolia*), sweet fern, and bayberry (*Myrica pensylvanica*).

We didn't add any amendments, as the soil turned out to be rich—not that we tested it, preferring to let free plants do the testing for us. Aside from watering and the removal of pokeweed, greater celandine, and raspberry seedlings from the planted areas, the first season was dedicated to an alternation between vigorous removal and artless planting at a spacing of three inches at the most. By the end of the first fall, we had cleared and planted an area that was roughly the size of one floor of a modest house. Everything was allowed to go to seed and was not mowed or cut back the following spring when the process was resumed in new areas. The size of the project more than doubled in the second year, and we should well exceed half an acre and over eighty species this coming year, with some assistance from particularly prolific species such as blue vervain (*Verbena hastata*), rabbit tobacco (*Pseudognaphalium obtusifolium*), yarrow, and late figwort (*Scrophularia marilandica*). But abundance can cut both ways: garlic mustard (*Alliaria petiolata*), a plant that native-plant gardeners discuss in tones that an oncologist might use to describe a troubling biopsy, made an appearance during the second season. We remove it on sight whenever possible, though I suspect that it will just be a part of the mix for the foreseeable future. Thus far, the other plants have not visibly withered or even ceased procreation in the face of the famed allelopathic powers of this noxious foe.

Barely two years on, this improvised landscape is a profusion of flowers, foliar textures, and the attendant buzz of insects

Barely two years on, this improvised landscape is a profusion of flowers, foliar textures, and the attendant buzz of insects.

that can be seen, heard, and felt. Staghorn sumac (*Rhus typhina*) immediately filled the void left by the invasive shrubs and lianas, and seedlings of black cherry and red oak are emergent everywhere amidst the herbaceous material. This is a native-dominated forest that is accumulating carbon and potential energy, to be channeled in innumerable directions aesthetically—or simply left to choose its own adventure.

Aldo Leopold famously notes that "(o)ne of the penalties of an ecological education is that one lives alone in a world of wounds." Increasingly, I have a first-aid kit to heal many of the wounds I find in our region in a way that is both ecologically and aesthetically generative. It just takes time, patience, work, and trust. But looked at another way, these earth-wounds are self-inflicted, stemming from a kind of mental disorder: an epistemological tradition that has given us clinical and seemingly omniscient access to the secrets of the natural world down to the level of genomes and subatomic particles, but has also compelled us to direct our gaze towards extraction, exploitation, and maximized profits. The hyper-specialization associated with these superpowers has resulted in the widespread conviction that planting for habitat requires CAD rendering, spreadsheets, dozens of meetings, and thousands of billable hours with all manner of experts before a single plant can be placed in the ground.

If we're going to change the course of American land practices for the better, things need to be simplified to meet people where they live. Campaigns like "No-Mow May" and "Leave the Leaves" are exemplarily distillations, and I'm hoping to swim in the same direction, encouraging people and cities to learn about and cultivate a few of the wonderful and ecologically productive plants that are heaving up through the pavement. Start with asters and goldenrods, which are easily identified and ubiquitous in fall. You'll find them growing at the edges of lawns and through the cracks in the grocery store parking lot. They're worthless, and thereby priceless.

THE DEEP PRESENT

A Return to Belonging

By Nohham R. Cachat-Schilling

We are at this park by a lake. The pines stretch so high in waxing heat soaked with their spice. Grandma's strong hand at the old cobalt enameled kettle, the roses of her summer dress waving, chipmunks stealing crumbs among the roots. Through a few blue windows, thin clouds slowly pass. Splashing in the lake with my feet, held aloft by my father's ruddy arms. *Weentxipahkihele,* leaves are praying. A storm cloud closes overhead; *Ratiwe:ras,* Thunderers.*

My earliest clear memory recurs as a dream across my early years, unclear, unsettling; dreams charged with memory of Lake St. Claire, Corn Island, Taghkanic. My grandma's sister told me, "You belong to the forest," which we understand as reciprocal.

I'm just a year old in Grandma's snapshot in Horseheads, New York, laughing in my Grandpa's arms, next to a row of serviceberries at the family orchards. Back home, Dad and I always got yearling whips of osiers, birches, pin oaks, dogwoods, and pinxterblooms at the Agricultural Extension

* *Weentxipahkiekele* is an Unami Lenapeuw (Delaware) adverbial compound referring to the rustling leaves as the sound of a person praying and figures in the medicine name of a renowned elder. *Ratiwe:ras* are Kanien'kehaka (Mohawk) Thunderers, with whom the author's clan and name are associated.

Artwork © Jeffrey Gibson, courtesy of Sikkema Jenkins & Co., New York; Stephen Friedman Gallery, London; and Roberts Projects, Los Angeles.

Office. Mom would gently scold me when I picked wildflowers for her: "Never pick a wildflower unless you see a thousand more just like it." Our land flourished, though our '70s city-fled neighbors did not "dig it." My father would never allow non-native plants around our yard, except the apple orchard, where we passed his last hours.

Belonging is found in continuity and reciprocity. Fourteen thousand years ago, the forest was not here, but we were. As the Younger Dryas world yielded semi-arid tundra, that tiny glacier-hugging flower left its pollen behind and we cached our artful chert spirit points alongside, tutoring this generation on land legacy. For centuries, our history suffered the tortures of supremacism, being told by colonizers, revised repeatedly at the whim of strangers, only to be restored and vindicated in recent decades by the crumbs of empirical evidence kicked up in the academic fray.

Soon, wet and cool conditions brought the taiga, Our Mother's great, biomass-dense circumboreal forest. "Zombie fires" now herald the demise of this last wilderness. As disproportionate warming sharply increases thunderstorms in northern latitudes, wildfires also persist through the winter, reigniting come spring. Pikangikum Anishnabe Elders say that *Peeneysee Eshkotay* (guardian[-priests] of fire) send fire down with their eyes to renew the taiga, a unique superdense forest type that does not cycle well because beaver dislike conifers, while cold and lack of beetles together retard decay.

We watched the taiga retreat upslope and northward as warmth and dryness burned on the land. We bade farewell to the mastodon, cave bear, and ground sloth—remembered in Lenape narratives like "Yahquahwee" (derived from *ehahwagawi,* "it has curved 'antlers'"), "Great Bear," and "Naked Bear" (which is possibly giant ground sloth)—but only after much bloodshed and gouging of the land with Ehahwagawi's tusks. Battle blood and the deep stomping of great beasts are remembered in cranberries and the pothole ponds around which they grow (*pakwim, pacim,*

Belonging is found in continuity and reciprocity. Fourteen thousand years ago, the forest was not here, but we were.

Lenapeuw, Nashawe). Tradition says that the tuskers took their refuge in the far Northwest, as confirmed at Wrangell Island, where a marooned population survived until about 4,000 years ago. Ehahwagawi''s departure ushered in the mixed, then predominantly deciduous forests that most of us know.

Through all this transformation of the land, we relied on transmission of narrative, our library. Transformation, continuity, and reciprocity are dominant cultural elements that continue to ensure our survival. We are here still because we belong to this land. Yet, gone by the hand of Settler Colonialism are the wolf, American chestnut, slippery elm (favored wigwam covering), American elm, passenger pigeon (major food and spirit-being)—a host of species erased in mass extinction across North America. Reciprocity was broken. I and others have researched and written on colonial period extinction, a gap in our national memory.

We belong to this land because Our Mother formed us here, and our form of belonging is caring for Our Mother. Traditional Native Medicine (TNM) and traditional knowledge take shape in traditional narrative, taking two forms among Northeast Algonquians: *achimewakan* and *athiluhakana* (in various dialects). Witness testimony—whether recent or ancient—or traditional narrative without a specific witness are our forms of remembering our past, our present, and our wisdom.

In "Hobomok kah Mohgwamiskw" (Abbomoco and Giant Beaver), the ancient glacial lake, *mishemachepaug,* is remembered along with the suffering brought on the People by Giant Beaver. Responding to the cries of grief from the Creator's children, Hobomok pursues Giant Beaver in a *misool* (*mishoon,* a pirogue) burned out from a giant hemlock. After pursuit three times around the great "badwaters," Giant Beaver is cornered at Tawwat ("at narrows"), where she is fatally struck. Her body is remembered as the red arkite Sugarloaf monolith and Pocumtuck Ridge (Wequomps and Amiskwolowogoik, Deerfield and South Deerfield, Massachusetts). After throwing boulders to destroy Giant Beaver's dams, Hobomok released the bad waters, and Wittum poured down medicine water from the falls of Kunnckwaciw (Mt. Toby massif), sacred land of Nepesuneag ("medicine hill") with its many cascades and grottoes, the most biologically and geologically diverse place in Massachusetts. The land was thus healed, yielding the fertile planting lands called *nunnabohke,* on which the Creator assigned stewardship to the People, and to the now hunting-sized beavers, *miskeketash* (wetlands): reciprocity.

Transformations of our land and culture are housed within continuity, centered on reciprocity, and remain connected on our path. Stewardship is specific to each tribe, clan, and place, but our ways have been perversely co-opted by agencies, both red and white, to promote for-profit exploitation agendas. Their sustainability is a rumor, a ghost that steals life under the cloak of darkness.

Nohham R. Cachat-Schilling (Kanien'keh:ka-Nashaue) of medicine person lineage, works in research and co-operates an historic farmstead demonstrating traditional sustainability on unceded ancestral land.

We took from the land with incomparable frugality and true sustainability. Our northeast wigwams of sapling wood and bark or mats are carbon-neutral—where we cooked and heated efficiently with high-density occupancy under domed-roof architecture. Our total footprint is marginally visible. Today, with only 30 percent of the historic beaver population left, no ancient uncut forests, and comparatively massive logging extraction, it is science fiction for "forest management" to portray itself as preserving the native ecosystem.

Our footprint is hard to see by intention, not due to underdevelopment. While our Mississippian Algonk cousins exploited their land by building megacities, we chose differently. We successfully engaged sustainable mixed horticulture and hunter-gathering by lightly using a wide array of resources such that Europeans obtained a bloodied land still virginal in richness. What is theoretical to you is immediate to me.

Our traditions speak day-long to our frugality. In *"Aniskayikuch ka Nimich"* (Dancing Ants, Kawawachikamach), Quebec Elder Chwaan Piyaschichaaw tells of two old women collecting soggy, fallen wood in wet late winter. One elder rips away the top of a dryish fallen log, unwittingly exposing a colony of ants. Night after night, they all endure bitter cold and the midnight chanting march of some unknown creatures frightening and waking them. After many sleepless nights, other elders intuit the cause. They witness the march of ants chanting, "Put it back; put it back. Make it warm again." Once restitution is made, warmer weather returns, and the midnight marches cease. It is a cautionary lesson that our every small action is to be taken with consideration, teaching that the importance of close observation, including what is unseen, remote.

By modern contrast, Mount Holly was a diversity hotspot that died due to cultural neglect. Guided by my grandma's sister, Mount Holly instructed me on all things from botany, geology, medicine, and spirits, to history and textiles. Here, my second

vision came, and I learned about intergenerational trauma, repeated removals—of people and forest both. I learned also about re-establishment, healing, and restoration. When the day I had to live far from this place came, my heart felt torn, and my bones cried out to me from among the roots. *Again.*

"*Moxomsena Pephokwus*" (Our Grandfather Red Cedar) tells how seven renowned sages vanished, later to be rediscovered by some pure youths on prayer pilgrimage in the rocky ridges in the form of seven unique boulders—one of which suddenly spoke. Pursued by needy people seeking answers, the Seven retreat, transforming into beautiful evergreens, some of whom appear as red cedars. Recognized as descended of the same lineage, white pine and red cedar were differently endowed when formed by the Creator. Both are recognized as great living medicine persons. Still overburdened, the Seven vanished again, transforming into the Pleiades cluster, where our spirits go for counsel before our journey to the next world.

Each tree connects to medicine, cermony, narrative. My personal archive counts more than 120 medicine plants, not including minerals and animals. *Sipuamantikan* ("creek fishing device," creek plum, *Prunus americana*) is chosen for a fishing pole by the wife of Kepahwis, the Lazy Hunter. In desperation, the elder wife sends her remiss hunter fishing. Not refusing a direct request, the husband sets out on what would be an incredible adventure of chance ending in good luck. We learn from this the value of taking what is offered, not taking advantage, and doing our duty. Few now know that creek plum was chosen because it is women's medicine—used to stun trout trapped in low summer creek pools, when the quick, clever fish are easily caught. The hook is also medicine, called *mpisun* ("bait," but also "medicinal tea"). With a mother's medicine given, we know Kepahwis will succeed.

Economic, ecologic, and spirit knowledge of trees from our cultures is almost inexhaustible—and mostly unknown.

Economic, ecologic, and spirit knowledge of our trees is almost inexhaustible—and mostly unknown.

Who can tell why smooth sumac is called *kelekanikwinakw* (*kekelekw* = laughing + *hikan* "device" + *winahkw* = pith-stemmed shrubs) and shining sumac is *glitskenikan* ("humiliation device"), while staghorn sumac is *xallamentsi* ("heavenly berry/nut tree")? Between these three species we derive bird hunting arrows, flutes, antiseptic gargle, smoking mixture, tobacco addiction cure, immune-boosting tonic, putting accused "criminals" to the test, yellow pigment, "revenge medicine," bleeding control, vermifuge, disinfectant, tanning, and more.

A new story is happening at Maguonket, on the Kwenitekw in Massachusetts, where two elder survivors of persecution find refuge in a place blessed by *manitowak,* on ancestral land. Here we are restoring heritage crops and medicines of both our Indigenous and colonial ancestors, carbon-negative, while removing introduced species and re-establishing diversity through a living plant library collected locally and carried here on our journey of refuge. Here we heal our community and ourselves, while diversity re-emerges on a slice of mountain-to-floodplain habitats, including a remnant Aeolian dune from that same glacial lake of our formative story. Here live three of the oldest trees in our town, garlanded in epiphytes, beside our new apple orchard. Despite the logging and degradation just beyond our boundaries, *here* is a return to belonging through the rest of our lifetimes, which we bequeath to the seven coming generations.

ART ENTANGLED

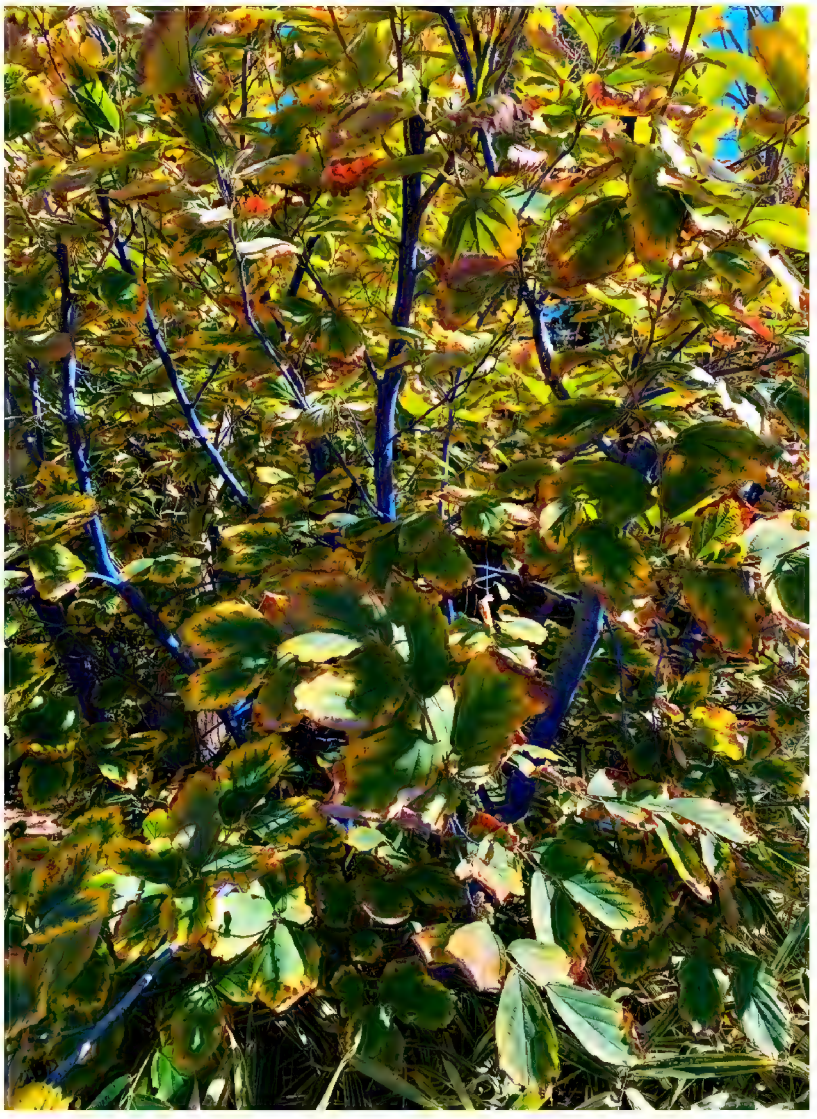
The Blue Trees

By Shuchi Saraswat

It was an arborist who first told me about the blue trees. We were out on a walk in Boston's Back Bay, it was bud burst season, and all that wild reemerging had me a bit in love with the city again. She asked if I had heard about the new installation at the Peabody Essex Museum (PEM) in Salem. I hadn't. Artist Konstantin Dimopoulos had collaborated with local artist Wes Bruce to paint the trunks of trees blue. It was one of several such installations all over the world, but the Salem installation had been met with mixed response. People worried that the blue paint wasn't safe, the arborist said, but it was a non-toxic solvent—and besides, she reminded me, trees don't do much oxygen exchange through their bark. People do get protective of their trees, don't they? She smiled. I sensed that she was amused by the controversy.

Two months later, I traveled to Salem to see the blue trees for myself. I arrived in a hot and sticky temper. I had mistimed my departure and was stuck in summer highway traffic under a sky mottled with clouds. When I reached the museum parking garage, the attendant had just let the last car through, and she waved her arms at me, gesturing outward. "Park somewhere on the street," she said, and I eventually found a spot in a lot by Broad Street Cemetery—a historic, raised burial ground with mature oaks and maples that had an immense, otherworldly presence. The effort to get to the installation and the welcome sight of one oak's canopy against the sky had perhaps unfairly influenced my expectations. When I reached the Blue Trees, I was a bit baffled. *Is this it?*

They were in PEM's Axelrod Walkway Park, a narrow stretch on the east side of the museum's main entrance that served as a corridor between two commercial streets. On one side of its brick path a thicket of bamboo, witch-hazel, and low shrubs stood, tangled and undefined, and on the museum side, two large plots of neatly spaced, well-maintained trees. For the installation, the artists had chosen to paint the branches of a few witch-hazels by either entrance, the trunks of about a dozen young ginkgos in the park, and three more ginkgos isolated in grate-covered pits along the shops on Essex Street. *Blue, blue, blue.* I've always been inexplicably drawn to the color in all its variations and intensities, maybe because, as William Gass once wrote, "Blue is ... the color of interior life." And in the natural world, blue indicates not what is soil-sprung but celestial. The sky, the ocean. The color of a mountain range in the distance, which is not a color but a lack of one, yet perceived by the able-sighted human as a muted, stone blue. But Dimopoulos' blue



was jewel-toned, royal, with all its intensity but none of its seriousness. In various interviews, he has said that he wanted his blue trees to be surreal. But there was something almost childlike about the effect of that color slathered over the brown trunk and low limbs of the ginkgos. It didn't evoke wonder—and I am prone to wonder when in the presence of trees—but, instead, Dr. Seuss. And yet the sight *was* startling—and that, of course, was the point.

Why were the trees blue? Two placards placed on the outer wall of the museum, behind the ginkgos, anticipated the question and answered it. Dimopoulous, a conceptual artist, painted the trees blue to call attention to deforestation. This was an associative leap that could only be made with the aid of a placard, yet even with this prompt, it was a grand and hollow explanation. The placard said little else—nothing about the species selected—among them the extraordinary ginkgo, slow growing but resilient, and which, I had learned from my arborist friend, had become a species of choice by urban foresters throughout the country. The trees had been generalized, made metaphorical; a few trees to stand for them all. The placard did include a note about the non-toxicity of the paint. Safe for critters, it said. Yet how could Dimopoulos be so certain? Birds and insects—tetrachromats, with four cones in their eyes—experience color in a far broader range of hues than humans; we can only begin to understand how they visually perceive the world. And how a blue tree may disrupt it.

But depth was not the artist's aim, only human provocation. And in this, Dimopoulos had succeeded. Nearly every person who walked through the park noticed the blue trees. They paused, took photographs, audibly asked why the trees were blue. They moved toward the placard. Read it aloud to their companions. Dimopoulos had succeeded in getting people to pay attention.

Another simple yet profound element of the installation was time. The trees would remain blue until nature determined otherwise. From April until—when? In October I visited them again with my partner and my step-kids. Peak tourist season in

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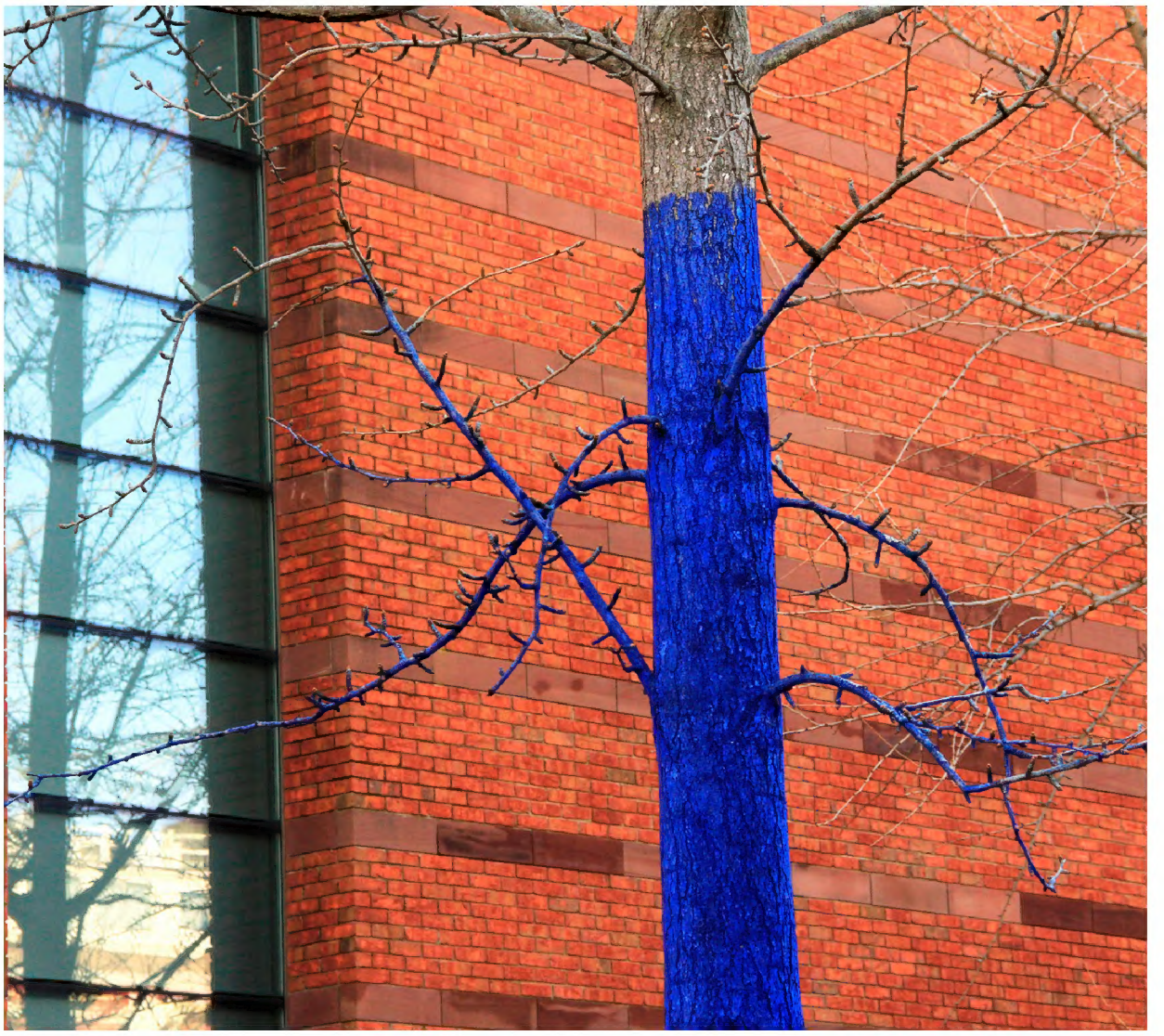

The Blue Trees (Konstantin Dimopoulos) in locations at the Peabody Essex Museum in Salem, Massachusetts. *All photos by the author, 2022.*

Salem. We moved through the thick crowd, the four of us forming our own space. It was difficult for me to see beyond the scope of the family; there were simply too many people. The blue trees became a part of the spectacle—nothing more than another family in costume. In the park, we could hear the busker on Essex Street, his drum beats pulsed orange; I could feel his music in my ribs. A person with a clipboard gathered her group for the next tour. I was thinking about witches, and while looking at the trees from a bench, tall and still over the heads of all those people, an image flashed before me. A noose rope hanging from the gallows. We were, after all, near the day when the veil between the world of the living and the dead thinned.

A month later, on a walk through the Arnold Arboretum, I paused to admire the fluorescence of the ginkgos along the base of Peter's Hill. Had they ever been more brilliant?

Then in December, I traveled to Salem once more. It was a mild day between Christmas and New Year's. Six months had passed since I had first seen the blue trees, and I confess, they had stayed with me. I wanted to see them again, to see how the months had altered them.

But the blue on the ginkgos had stayed strong. If anything, with the trees' leaves now shed, the color appeared even more vibrant. I could see where the on-site artists had stopped painting, and the sky burned bright through the unpainted upper branches. Winter is blue, I thought. And the bare trees take the color of the sky.

It was a weekday, and the park was quiet. Few people walked by, yet still, nearly all paused to look at the ginkgos. A woman with a baby in a stroller passed me, a toddler at her hip. I remembered a story Dimopoulos told in one of his interviews. At the Vancouver installation, he had noticed a four-year-old girl detach from her mother and run toward a blue tree and hug it. To him, it was clear that they walked regularly through the park. But had she ever noticed the trees before? he wondered. Where she takes that encounter, he said, I don't know. What she does with it would be up to her.

Records Label Creation and Deployment

By Adam B. Banks, Curatorial Assistant

A records label hangs from every accessioned plant in the Arboretum, recording scientific name, accession number, provenance, and other documentation. The Curation department creates some 2,000 new labels anually—for new plantings, as scientific names change, and to replace missing labels (often discovered during the annual inventory, which in 2022 included Hemlock Hill). We produce labels on a CIM Maxima 841 label embosser, which rapidly and sonorously stamps letters and numbers into the two-by-three-inch aluminum cards, completing each in roughly 45 seconds. Out in the field, we typically hang the prepared label on a basal screw or small branch. For trees or large shrubs, we first install a 3-inch stainless steel screw at the trunk's base, fasten the label with seven twists of 22-gauge electrical wire and a loop around the screw, and finish with a series of wraps spiraling down to double-thread the label's eyes. Branch labels are attached with the same seven twists, a generous loop around the branch to allow for future growth, and finally seven more turns and a final single coil above the branch known as the "Curatorial Twist."

Photograph by Jamila dePeiza-Kern

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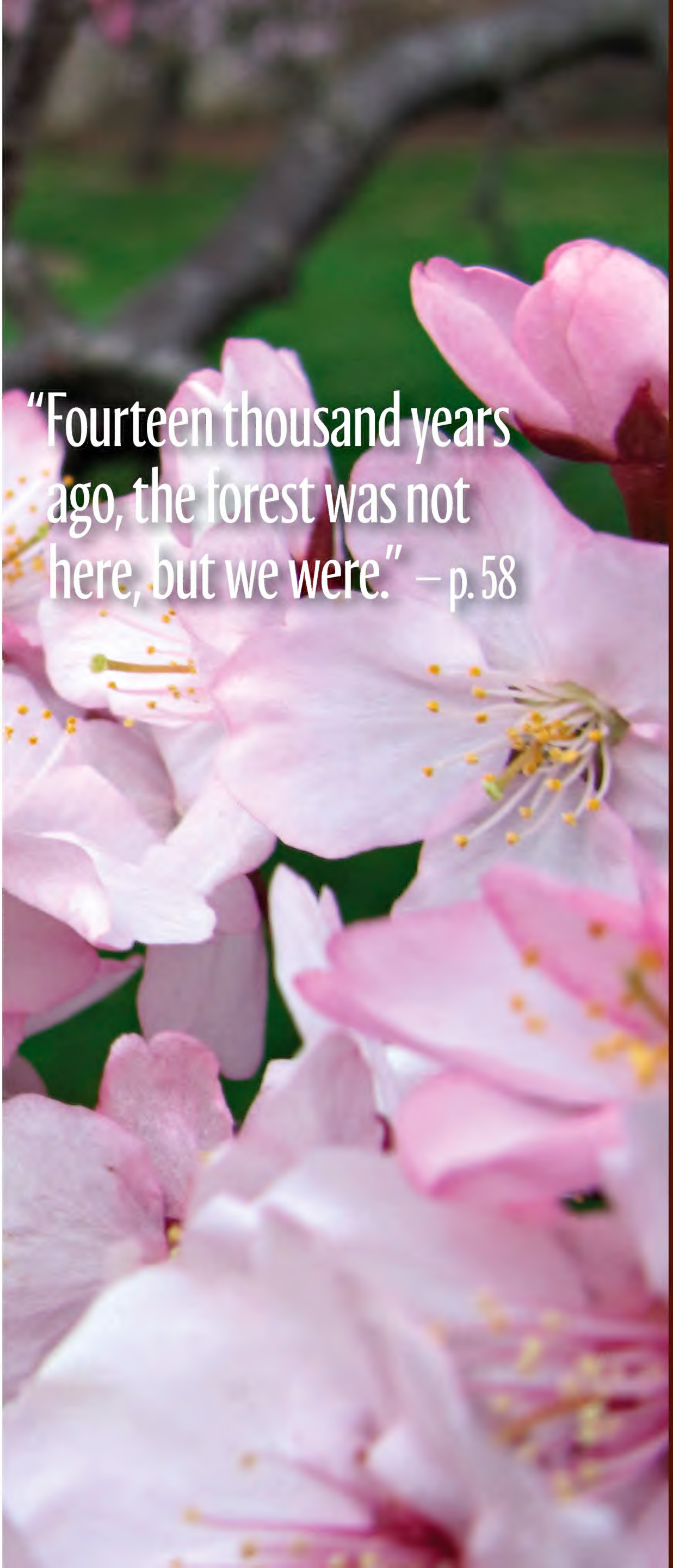
Accessioned plants in the arboretum.

7

Turns of wire in the "Curatorial Twist."



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